the OIL AND GAS JOURNAL

NOVEMBER 26, 1956

Compression Increases Mean . . .

HIGHER OCTANE APPETITES IN '57

. . . but the jump won't be as big as last year's . . . p. 44

› **Water Shortage Pinching Texas Floods.** p. 50

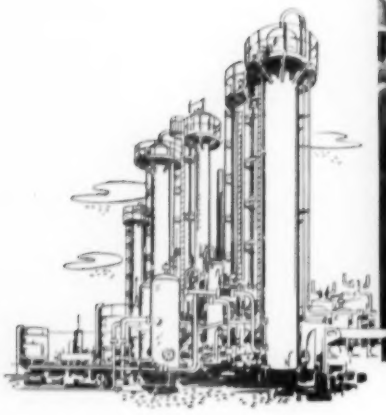
› **Polyethylene by Atomic Processing.** p. 54

› **Mountain Basins Due for New Study.** p. 124

How to Plan a Microwave Radio Relay System. p. 83

Wyatt

...will be there



• Just how the Petroleum Industry is going to meet the requirement of doubling its refining capacity in the next twenty years is beyond our calculation.

What we do know is that it will call for Wyatt's shops to keep moving pressure vessels into refining plants the country over, as this one is going into service in the Lake Charles plant of Cities Service Refining Corporation.

Wyatt's
HOUSTON-DALLAS-NEW YORK-TULSA

MANUFACTURERS AND ERECTORS SINCE 1913

A Glance Ahead . . . at press time

These trends will make TOMORROW'S NEWS

Legislation to cure Long Beach's subsidence problem probably will be introduced at next year's session of the California Legislature. Until the city can unitize its harbor oil properties with those of nearby oil companies, no pressure-maintenance program can be undertaken to bolster the sinking surface. The bill probably will be jointly sponsored by the city and the State Lands Commission.

Look for some new information soon on successful commercial dehydrogenation of high butylene feeds for butadiene manufacture. Economic success is claimed for feeds running to 100 per cent unsaturate feed stocks.

Several refiners are considering adoption of Shell Oil Co.'s two-stage fluid catalytic cracking process unveiled last spring. No contracts have been closed yet, but the method used at Shell's Anacortes unit, or alternates which lend themselves to conversion in existing units, are under consideration.

Tanker loadings will be speeded greatly by development of a 10,000-bbl.-an-hour crude meter under industry-sponsored research. Largest meters now available measure 2,800 bbl. per hour and are not considered practical at terminals where supertankers load at rates up to 40,000 bbl. per hour. Costly delays now result from using tank gages which take time to check out.

A good profit year for oil is in prospect. Reports of 80 producing and refining companies for the first three quarters of this year show an increase of 18 per cent in net income compared with 1955. Financial experts believe these companies will end the year with net profit at least 15 per cent above 1955, despite the current weakness in gasoline.

The next major offshore pipeline—planned by Tennessee Gas Transmission—will be the most ambitious ever undertaken in the Gulf of Mexico. The builders will encounter water up to 100 ft. deep, twice the depth yet challenged by pipeliners in the gulf. Present submarine techniques will undergo a severe test as the expense and difficulty of the project will multiply with the depth. T.G.T. will lay 120 miles of 26-in., 20-in. and 12-in. to tap 6.6 trillion cubic feet of gas off Cameron and Vermilion parishes (The Oil and Gas Journal, September 24, page 84).

Support is growing for the development of an accelerated road test for asphalt uses, a reflection of the assured large expansion in road building over the next several years. The present practice using strips of highways for road testing takes 5 to 10 years to determine results. Present laboratory testing does not give full information, specialists in asphalt uses agree.

Look for an announcement soon that a large U. S. company will build its first refinery in Canada in the Toronto area. The company has production and marketing in Canada and expects to expand all phases of its operations rapidly.

Continuous analysis of intermediate refinery streams is catching on. It is now in use on a few process units to give running data on feed and product streams. The next application is likely to be a continuous analysis of metal content of catalytic cracker feed stocks, to aid in controlling contamination of catalyst.

The OIL AND GAS JOURNAL

NOVEMBER 26, 1956 • VOLUME 54 • NUMBER 82

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OIL AND GAS PIPELINES • REFINING • PETROCHEMICALS
EXPLORATION • DRILLING • PRODUCTION • FIELD PROCESSING

. . . an integrated magazine serving an integrated industry

TECHNOLOGY—OPERATION

Pipelining

Long Pipeline Wrapped With Plastic Tape **70**
By Paul Reed
A 122-mile, 22-in. line has been wrapped successfully with a polyethylene plastic tape. H. C. Price Co. and Houston Contracting Co. did the job for American Louisiana Pipeline Co. in Michigan and Ohio.

How To Plan a Microwave Radio Relay System **83**
By D. R. Marsh
Part 1 of a two-part series on how to select suitable sites, determine antenna heights and propagational reliability, and select towers, buildings, and power accessories.

Microballoons Live Up To Promises **91**
By W. A. Keutgen
Significant reductions in crude-oil evaporation loss have been reported by four companies using a Microballoon sealing foam in cone-roof working tanks.

Pipeline Patrol: Construction Tables **104**

Drilling-Production

Rig Upkeep Has Big Price Tag **73**
By Robert W. True
Here are costs of operating labor and maintenance for rotary drilling rigs in four different depth classifications. Current labor costs represent over half the total, but maintenance expenses range from $150 to $320 daily.

Wilmington Flood Operators Battle Ocean-Water Corrosion **76**
By Charles H. Jones, Jr.
Cathodic protection and use of corrosion-resistant materials stop trouble in shallow-water wells.

Highly Saline Flood in Oklahoma City Wilcox Reservoir **79**

Field Processing—22: Temperature Control in Lease Separation **95**
By John M. Campbell

Modern Drilling **103**

Refining

Richfield's New Waste-Water Plant **80**
By D. H. Stormont
A unique, compact treating plant which uses floating-roof tanks for preskimming and dissolved-air flotation cells for removing remaining oil is handling waste water successfully.

Pointers For Gas-Engine Overhaul **86**

Microballoons Live Up To Promises **91**

Effect of Sensitivity on Road Octane Number **93**
By William E. Morris
On an over-all basis, gasolines with a low sensitivity are superior in road performance to gasolines with a high sensitivity, when both gasolines have same research octane number.

How To Check Octane Numbers Above 100 **96**

On The Job . . . In The Plants **97**
Reducing air-line explosion dangers; end-welded studs eliminate drilling, punching, and tapping; other items.

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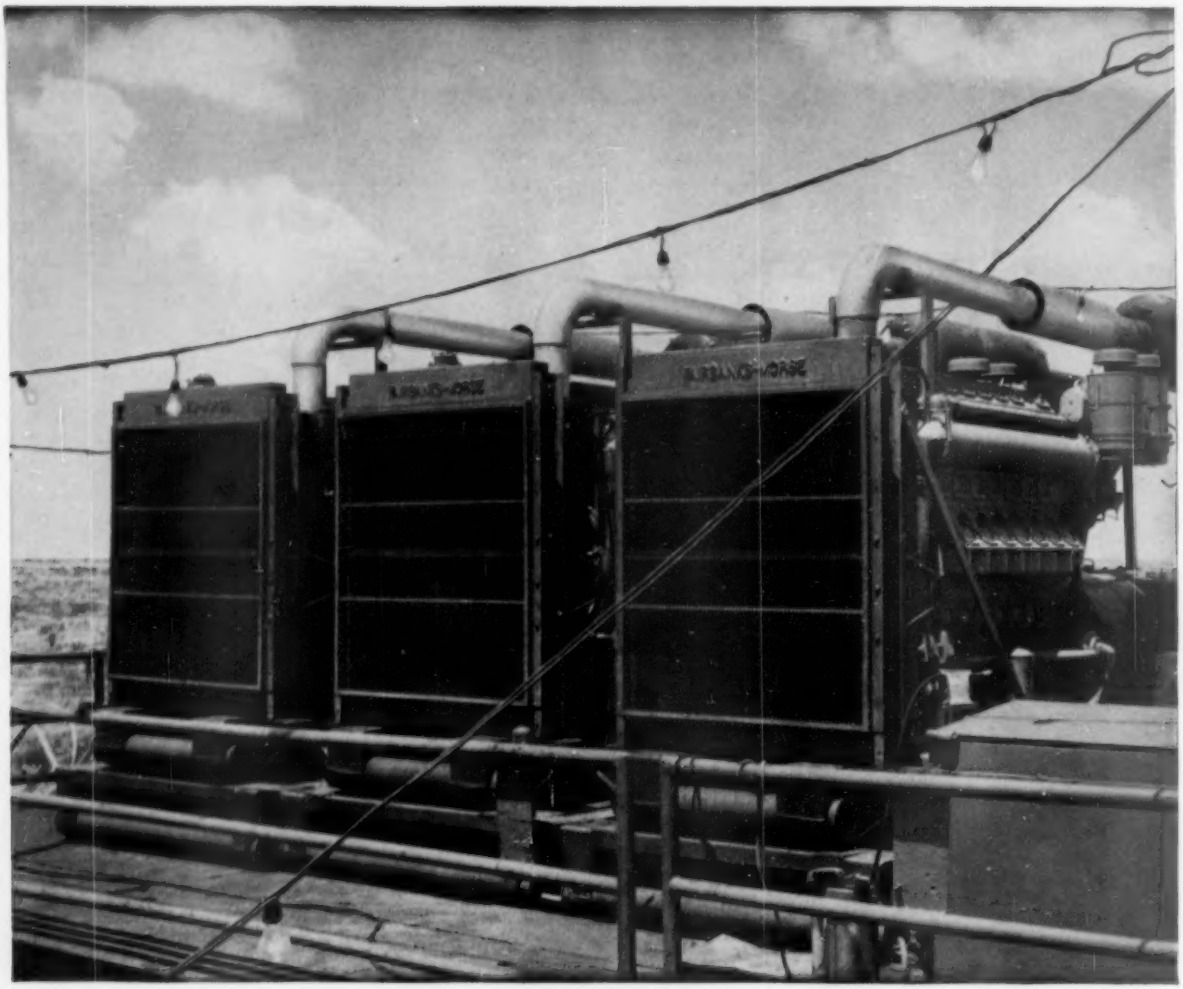

The 38-F-90 is a drilling engine

Here's Why

Fuel? . . . The 38-F-90 burns gas, propane or liquid fuel with the inherent economies of diesel compression.

Hp. rating? . . . Continuous slush pump rating is 75 hp. per cylinder, and the six sizes (4-5-6-7-8-10) include the right engine for any job between 300 and 750 hp. Whether four cylinders or ten, it's the same engine, the same width and height, the same operating technique. Many parts are interchangeable.

Speed range? . . . The 38-F-90 is rated for continuous heavy-duty service from 450 to 1200 RPM. This range is right for any mechanical, hydraulic or electric drive.

Give and take? . . . The 38-F-90 is a Fairbanks-Morse engine. This means that it will give service and take punishment. Its simplicity and its stamina are the result of its Opposed-Piston two-cycle design and its all-steel welded frame.

This all adds up to why the Fairbanks-Morse 38-F-90 is a *drilling* engine. Fairbanks, Morse & Co., Oil Field Division, Chicago 5, Illinois.

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INJECTOR-STICKING is the problem at hand here. In this case, a combination of Du Pont FOA-2 and Metal Deactivator proved to be the solution.

Now—a new Du Pont Service to help you solve diesel-fleet fuel problems

When a diesel operator encounters a fuel problem—such as injector-sticking or filter-plugging—he often tends to blame the refiner for his troubles. And with a big fleet operator, such complaints are likely to jeopardize a substantial amount of business. It is at this point that your customer relations can often be improved by the analysis and opinions of a third party, a Du Pont technical representative backed up by numerous Du Pont facilities.

To help you solve these problems as quickly and easily as possible, our Du Pont Petroleum Chemicals Division automotive specialists will be glad to work with your men. Their practical experience with this type of problem can be added to your own experience. And our five conveniently-located regional laboratories, as well as the main Du Pont Petroleum Laboratory, can also aid you in this work.

In cases where filter-plugging occurs—in both truck and tractor fleets—our service representatives have found that Du Pont Fuel Oil Additive No. 2 (FOA-2), or a combination of FOA-2 and Du Pont Metal Deactivator (DMD) helps overcome the trouble. This same combination of additives has proved helpful also in overcoming injector-sticking. However, since different diesel fuel stocks vary considerably in composition and response to additives, each problem must be studied on an individual basis.

Different diesel engine injector designs may also affect the performance of fuels. We are, therefore, also working with diesel engine manufacturers on injector-sticking problems.

So if you are encountering fuel problems with any of your accounts, it may pay you to discuss them with one of our automotive specialists. And you can request this service through any of our offices listed below.

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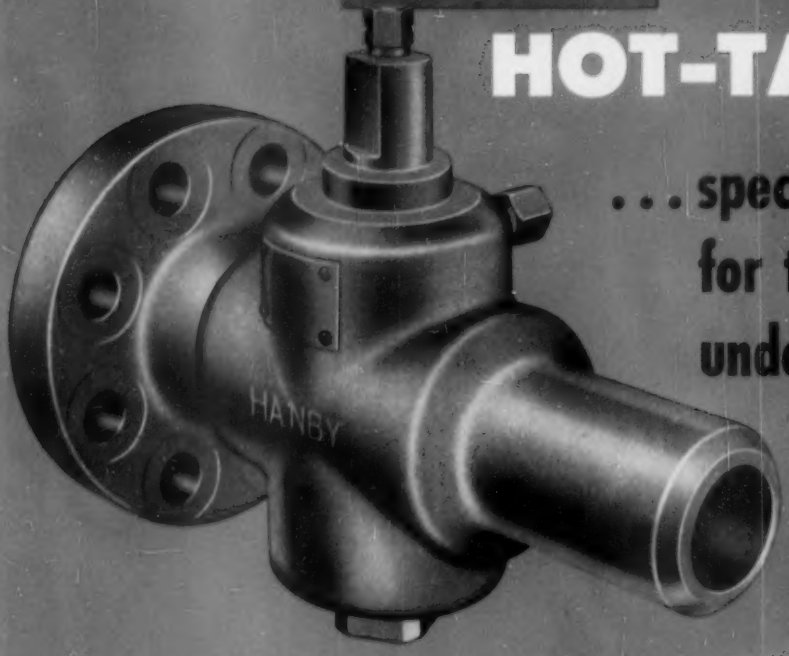
This NEW HANBY HOT-TAP VALVE



. . . specifically designed for tapping gas lines under pressure

GAS TRANSMISSION COMPANIES have been asking for a valve that is *specifically designed* for use in tapping gas lines under pressure . . . and *HERE IT IS.*

BODY . . . is a solid, one-piece forging with no bonnet to leak or bonnet bolts to corrode.

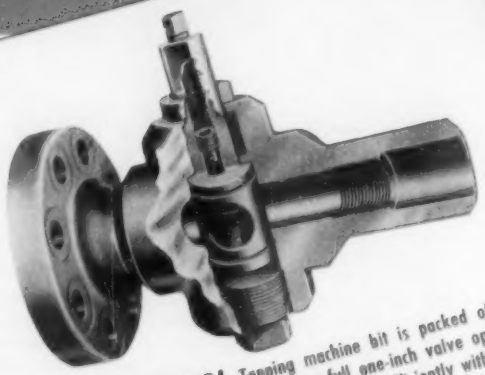
WELD-NIPPLE . . . of 2" diameter, in any desired length, is regularly furnished with 1" female internal threading two inches from the weld-end.

PLUG AND STEM . . . are of one-piece construction.

STUFFING BOX . . . is fully enclosed as part of the body and can be readily re-packed by inserting plastic packing through a removable set screw in the side.

In Addition . . .

. . . to hot-tap applications, this is an excellent blow-down valve for scrubbers and drips or low places in the line. Internal threading permits the use of a 1" syphon to the bottom of the pipe.



HOW IT WORKS! Tapping machine bit is packed off at flanged end and applied through the full one-inch valve opening and welding nipple. When tap is made, bit is sufficiently withdrawn to permit valve closure as shown by cross-section. Connections are then completed and valve re-opened.

Ask an "Oilwell" Specialist in Pipe Line Equipment to show you this Hanby Valve . . . or write for full information.

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Walworth High Pressure Lubricant Gun. This is the only gun available today that satisfactorily handles the stick form, full-bodied lubricants needed for proper lubrication and sealing of plug valves. Easy to operate; two Jumbo Size Lubricant Sticks fill the barrel.

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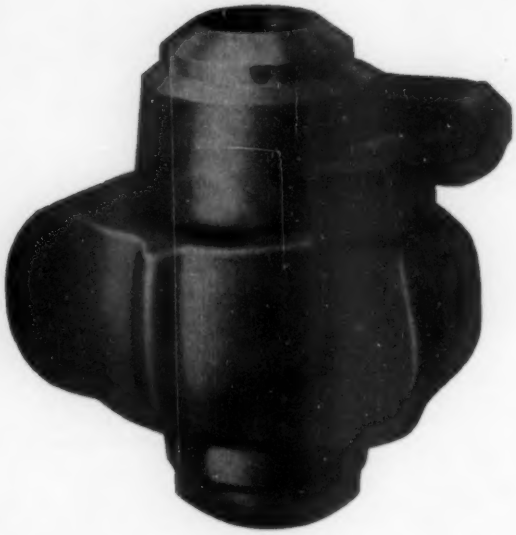

Distinctive features: **Lighter but stronger** — its unique design results in minimum bulk and weight yet places more metal in shear to provide greater strength. **One bolt** — simplifies assembly and disassembly and serves only to draw tapered interlocking shelves together, carrying none of the load of the coupling itself. **Adaptability** — its design readily permits adapting it to numerous fittings, as well as pipe couplings. **Interchangeability** — any part for a given size and type coupling or fitting is interchangeable, permitting minimum warehouse stocks of UNIBOLT products and replacement parts. **Broad field of application** — ALL UNIBOLT products utilize the same basic mechanical design, only the seal rings, or gaskets, differ with the class of service.

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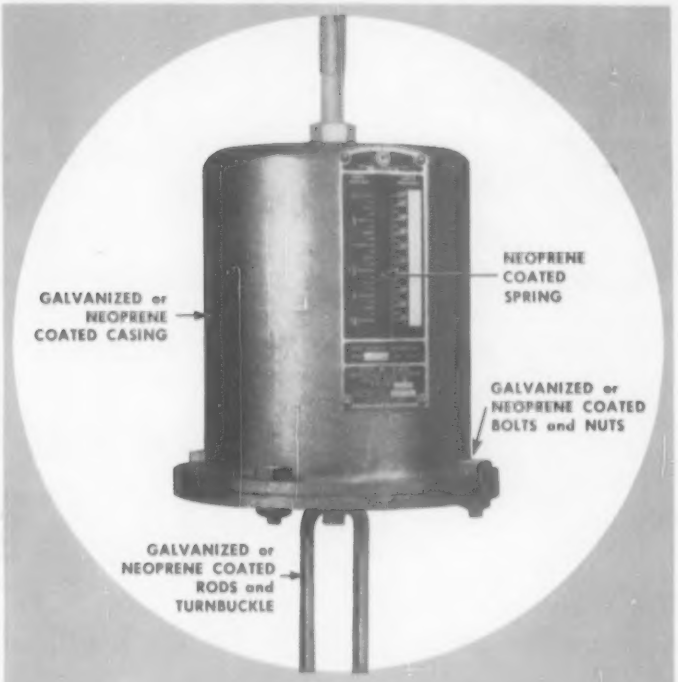
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GALVANIZED or NEOPRENE COATED BOLTS and NUTS
GALVANIZED or NEOPRENE COATED RODS and TURNBUCKLE

Another Grinnell First!

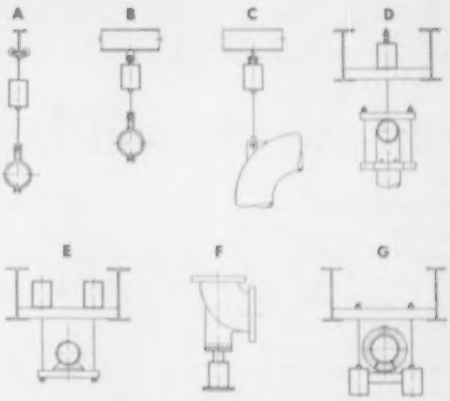
Grinnell pre-engineered spring hangers are now offered in two new lines to meet the need for spring hangers in installations subject to highly corrosive industrial conditions and to severe weather exposure.

These hangers are the result of extensive experimentation with various coatings for Grinnell's standard pre-engineered spring hangers. In addition to providing flexibility in pipe suspension, they provide versatility of application through their corrosion-resistant characteristics. They are . . .

1. Neoprene coated — for highly corrosive conditions such as those found in chemical plants and refineries. *All* parts of the hanger are neoprene coated to protect the base metal from a wide range of corrosives. The flex life of the spring is unaffected by the neoprene . . . the coating resists cracking or flaking over a wide temperature range.

2. Galvanized — for outdoor installations where weather conditions are severe. All parts of the hanger are galvanized except the spring, which is neoprene coated to avoid alteration of temper, hydrogen embrittlement and decreased flex-life of the spring — usual hazards to springs from the galvanizing process.

AVAILABLE IN 7 TYPES FOR THESE TYPICAL APPLICATIONS



(A) Rod threaded to top cap (B) Furnished with single lug (C) Two lug style (D) Top adjusting (E) Adjustable top and bottom (F) For floor support (G) Trapeze assembly.

Along with the obvious advantages of such corrosion and weather-resistant characteristics, consider these features . . .

- Maximum variation in supporting force per ½" of deflection is 10½% of rated capacity — in all sizes.
- Precompression* assures operation of spring within its proper working range, as well as saving valuable erection time. Reduced over-all height saves space.
- 18 sizes available from stock for load ranges from 53 lbs. to 12,000 lbs.
- Available in 3 spring lengths for travel ranges of 1¼, 2½, and 5 inches.
- Installation is simplified by integral load scale and travel indicators.

*Precompression is a patented feature.

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Western Heat Exchanger
CASE HISTORY

CUSTOMER: *Spencer Chemical Company*

WESTERN'S *Speed and Flexibility* PUTS SPENCER PLANT BACK *ON STREAM* IN JUST 47 HOURS!

SCHEDULE OF OPERATIONS
MARCH 29-30-31

At Spencer Chemical Company's Jayhawk Works at Galena, Kansas, on March 29, 1956, oil was bled into a compressor air aftercooler, through a valve failure, causing a fire in the shell side of a heat exchanger, completely melting out the admiralty extended surface in the air aftercooler. THIS RESULTED IN A LOSS OF 130 TONS OF NITRIC ACID PER DAY!!

The ability to redesign a prime surface exchanger to handle the heat load originally handled by a special extended surface bundle, and to fabricate from stock materials in thirty hours, emphasizes the importance of Western's speed and flexibility to our Engineering and Operating clientele.

Western merits *your* consideration on present and future heat transfer requirements.

5:40 p.m., Mar. 29

Call from Spencer Kansas City office, requesting retubing of an existing bundle of unusual design.

8:30 p.m., Mar. 29

Following engineering meetings on problem, Western engineer travels to Spencer plant, inspects damage, sketches existing tube sheets and other details affecting bundle fit; returns to Tulsa same night.

7:30 a.m., Mar. 30

Based on heat load, air quantities and flow, new rating is performed, permitting bare tube, prime surface bundle to do job of original specialized extended surface tubes, staying within pressure drop limitations on shell side of unit.

10:00 a.m., Mar. 30

Drafting Department starts on tube sheet layouts, from completely rated unit. Complete bundle drawings in hands of Shop by noon.

12:00 noon, Mar. 30

Stationary tube sheet, fixed tube and baffles drilled on three presses, with crew cutting 600 ¾" x 16 BWG x 20' admiralty tubes to 17' 2" lengths.

9:00 p.m., Mar. 30

Bundle completely assembled, electronic torque controlled rolling of 600 tubes at stationary and floating tube sheets begun. Completed, crated, and shipped by midnight.

4:15 p.m., Mar. 31

Spencer plant back "on stream," having received bundle at 5:30 a.m., completely installed by 10:00 a.m.

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H. W. SEVERANCE — 2416 Frankfort Ave., Louisville, Ky.

GOODYEAR INDUSTRIAL PRODUCTS
G.T.M.-Specified Style MHB
Rubber Covered Fire Hose
C
B
A
A Smooth, nonporous, long aging synthetic rubber tube
B Single horizontal braided construction combines strength with light weight and maximum flexibility
C Synthetic rubber cover resists oil, abrasion, sun and aging

G.T.M. offers the hottest thing in fire hose

THERE has long been need for a tougher, lighter weight fire hose with greater resistance to oil, abrasion and weather – especially around refineries and on oil transport vessels.

After thorough analysis of the problem, the G.T.M.–Goodyear Technical Man–and his colleagues, came up with the answer. It is a completely new hose – Style MHB Rubber Covered Fire Hose.

This new rubber hose is exceptionally flexible and light in weight. It is reinforced with a horizontal braid of high tensile synthetic fiber for extra strength. It is mildew inhibited throughout. And its specially developed rubber cover not only resists oil but snagging and hard wear as well.

If you want fire or wash hose that's built to withstand the toughest service, consult your Goodyear Distributor and/or the G.T.M. Or write, Goodyear, Industrial Products Division, Akron 16, Ohio.

RUBBER COVERED FIRE HOSE by

GOODYEAR

THE GREATEST NAME IN RUBBER

IT'S SMART TO DO BUSINESS *with your Goodyear Distributor. He can give you fast, dependable service on Hose, V-Belts, Flat Belts and many other industrial rubber and nonrubber supplies. Look for him in the Yellow Pages under "Rubber Goods" or "Rubber Products."*

They're Easy to Weld

Bethlehem Flanged-and-Dished Heads are easy to weld because they are made from grades of steel of uniformly high quality. And they come in a range so wide as to meet virtually every requirement.

Types furnished include ASME Code flanged-and-dished, standard, elliptical, flanged-only, dished-only, shallow-dished, tank-car, obround and double-dished. Diameters: up to 144 in.; thicknesses: 14 gage to 2½ in.

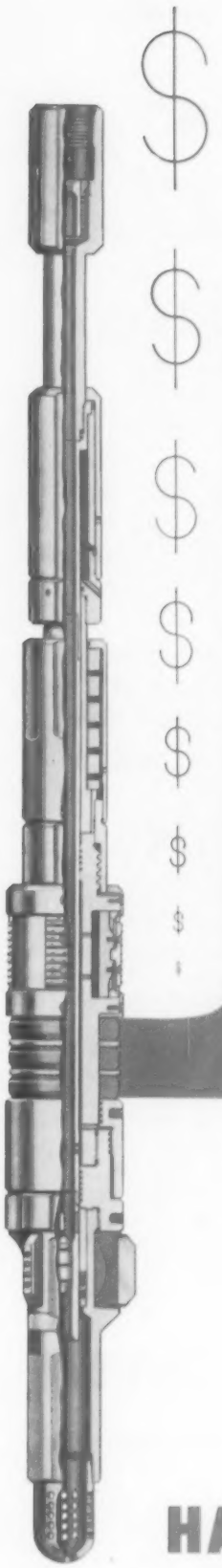
Bethlehem also produces heads with flued openings, standard manhole and hand-hole saddles, covers and fittings. To help you maintain production schedules, Bethlehem carries a stock of A.S.M.E. flanged-and-dished heads to ASTM A-285 Grade C flange or firebox steel, for prompt delivery.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL



EASES COST OF SQUEEZE JOBS

HALLIBURTON'S *hydraulic* RETRIEVABLE CEMENTER

Time-saving is just one of the many advantages you get with Halliburton's HYDRAULIC RETRIEVABLE CEMENTER (HRC). This versatile tool does many jobs . . . can be set and reset as many times as desired without coming out of the hole.

NO STRAIN ON TUBING

After the HRC is set, the packer will hold pressure from above or below without putting a strain on tubing. It is unnecessary to maintain pressure on tubing to keep the tool set. However, while setting, the tubing may be tested to 10,000 p.s.i. if desired.

NO STRAIN ON RIG

Setting the HRC is not dependent on the pulling capacity of the rig or the amount of tubing weight available. Complete operation for any job is by up-and-down movement of the tubing. Rotating out of the hole automatically opens the circulating valve so that the tubing is pulled dry.

NO STRAIN ON THE POCKETBOOK, EITHER

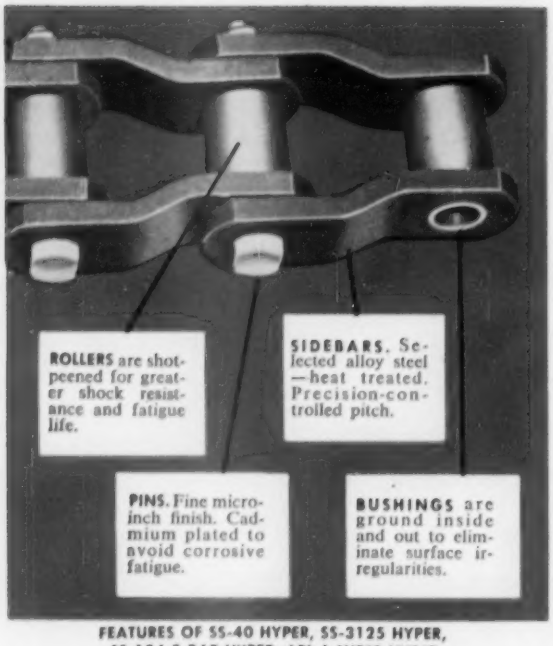
When you consider that just one trip is required to perform a series of squeeze jobs in rapid succession . . . and no drilling out time is required . . . it's easy to understand why Halliburton's HRC is the popular time and money saver among cost-minded oilmen. For complete details, call your local or district office of the Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

COMPLETE DATA SENT ON REQUEST

Get this valuable information for your Halliburton Service File

HALLIBURTON CEMENTING SERVICES

251 SERVICE CENTERS—JUST MINUTES AWAY FROM ANY RIG

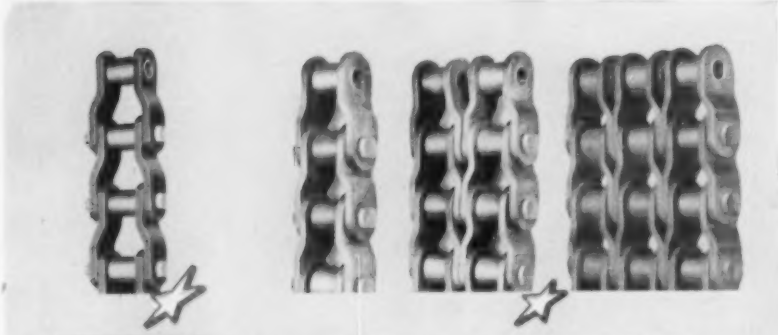

ROLLERS are shot-peened for greater shock resistance and fatigue life.
SIDEBARS. Selected alloy steel—heat treated. Precision-controlled pitch.
PINS. Fine micro-inch finish. Cadmium plated to avoid corrosive fatigue.
BUSHINGS are ground inside and out to eliminate surface irregularities.

FEATURES OF SS-40 HYPER, SS-3125 HYPER, SS-124 3-BAR HYPER, API-4 SUPER HYPER

Drilling deep or shallow--

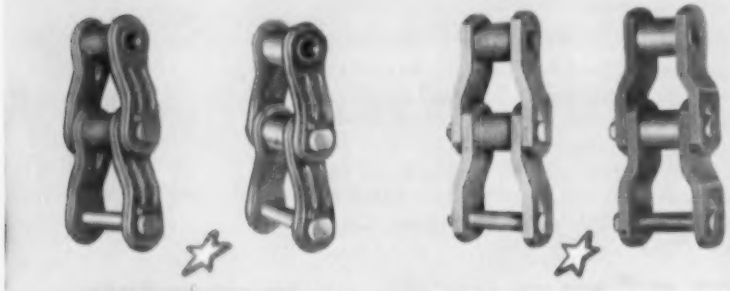
choose LINK-BELT API (SS type) chain

to get you there and back



SS-40 HYPER. Most widely used of all API rotary chains.

SS-3125 HYPER SINGLE, DOUBLE AND TRIPLE contribute unexcelled stamina to rotary, engine and hoisting drives.



SS-124 3-BAR HYPER AND SUPER HYPER are used for hoists and engine drives.

RED-HED chains answer need for good, durable, low-cost chain for shallow drilling.

Choose from the complete LINK-BELT line of API (SS type) chains . . . first choice in the field

Built and packaged for the toughest jobs . . . available at leading supply stores in the field

WHETHER it's hoisting or rotary service, deep or shallow drilling—Link-Belt has a chain for every need. More Link-Belt API chain is used than any other brand. That's because of features which have won acceptance from oil men everywhere. This chain is precision-manufactured—pitch holes and pitch are uniformly accurate . . . pins and bushings are ground to a fine micro-inch finish to eliminate fatigue-starting surface nicks.

Link-Belt API chains are double-boxed and steel banded—effectively protected from sand, grit and wet weather . . . easily identified. For the full story, get your copy of new Catalog 2680 from your Link-Belt office or supply store today. 14,240

LINK-BELT

CHAINS and SPROCKETS

LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 21, Odessa, Tex., Shreveport, La., Los Angeles 33, Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields.

Go First-Class on All Your Needle Valves, too

For high pressures . . . for low pressures . . . in all types of Christmas Trees, O-C-T Needle Valves have been tested and proved to be unquestionably the safest, strongest ever built.

O-C-T Needle Valves feature one-piece alloy steel bodies, welded bonnets for maximum safety and a multi-compound, non-crushable V-type packing especially developed to cope with those high pressures and high temperatures.

Stem packings are of plastic asbestos and aluminum foil compound suitable for 15,000 and 30,000 psi hydrostatic tests.

Each valve is subjected to a compressed air test under water before approval by inspectors.

The best in pressure gauge needle valves is by O-C-T!

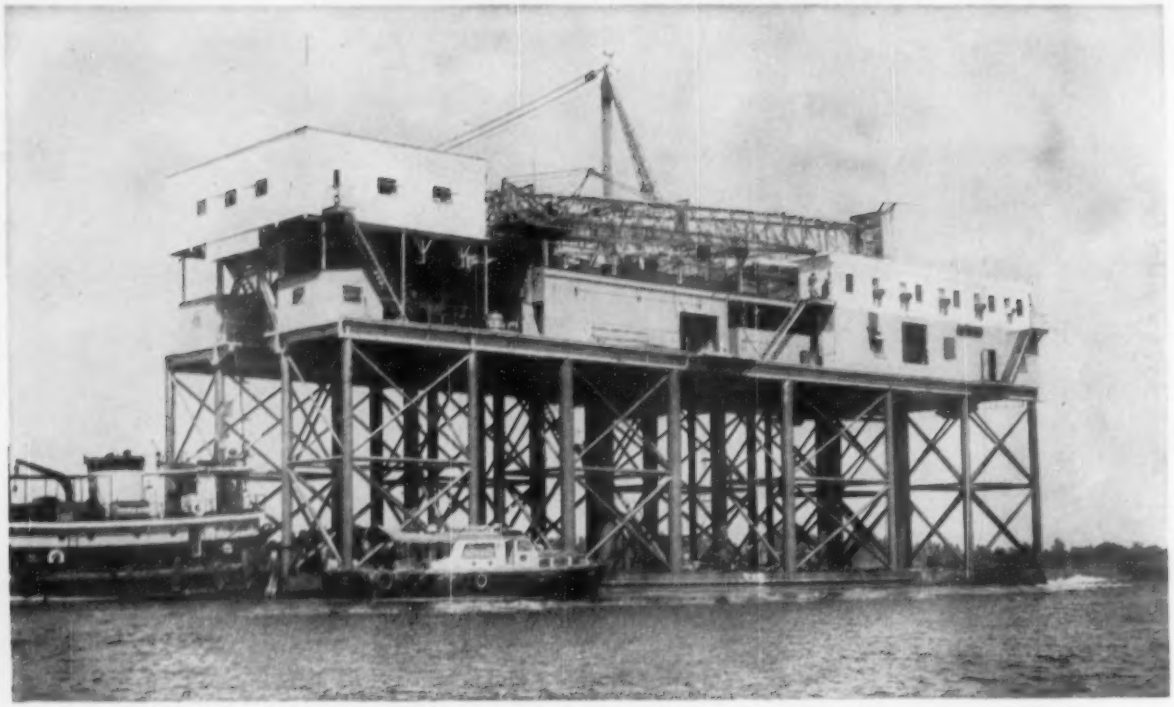
Available through more than 700 supply store outlets.

O·C·T

OIL CENTER TOOL CO.

P. O. Box 3091, Houston, Texas

Export Representatives, Sterling Areas — Le Grand, Sutcliff & Gell Ltd., Rochester, Kent, England. South America—East West Oilfields, C. A. Del Lago Hotel, Maracaibo, Venezuela. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston, Texas



Another for Odeco by American Marine!

ST. LOUIS TO JOIN CELEBRATED MR. CHARLIE AND JOHN HAYWARD

The third deep-water drilling barge that American Marine Corporation has designed and built for Odeco is shown above and at left on American Marine Corporation's huge capacity drydock for final outfitting prior to delivery. The new "St. Louis" is virtually an exact copy of the John Hayward, both patterned after the first of the greats, Mr. Charlie.

The St. Louis is an integrated submersible two story unit 180' x 120' with helicopter deck and air conditioned living quarters for 40 men. Drilling capacity is to 18,000 feet in 30 feet of water.

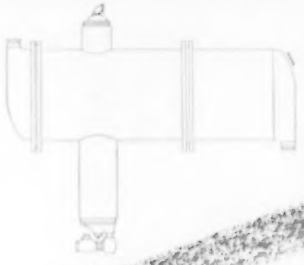
AMERICAN MARINE CORPORATION

FORMERLY ALEXANDER SHIPYARD

P. O. BOX 8126 NEW ORLEANS, LA. VAlley 2408

PIONEERS IN OFFSHORE DESIGN AND CONSTRUCTION !

Washington National Airport,
Washington, D.C.



Overall height 48 1/16" Approx.
Overall length 64 5/16" Approx.
Shell diameter O.D. 20"

the world's newest airports . . .

military and civilian . . . select

Warner Lewis Separators and Filters

for turbo and jet fueling systems
servicing today's modern aircraft

Allied Aviation Fueling Company, Washington National Airport, Washington, D. C. selects the model FCS-911-191ANC combination separator/filter designed especially for aircraft refuelers. Rated at 225GPM on jet and kerosene fuels, this unit meets all requirements of MIL-F-8508 for water separation and filtration. For information on a complete line of water separators and filters for mobile and stationary installation, write Warner Lewis Company, Division of Fram Corporation, Box 3096, Tulsa, Okla.

WARNER LEWIS COMPANY

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DIVISION OF FRAM CORPORATION

In Canada: FRAM CANADA LTD., Stratford, Ontario

Representatives in all major cities

HAVE BRAINS...

WILL TRAVEL

NO matter where you locate your new plant it's going to take brains to design and build it. The McKee organization is staffed by hundreds of specialized engineers with the *ability*, *training* and *experience* to design and construct projects of any size, anywhere in the world, for the industries we serve.

We have been doing this for more than half a century in thirty-five countries. It will pay you, on your new plant project, to investigate the cost-saving, profit-making advantages of McKee's one-contract engineering services.

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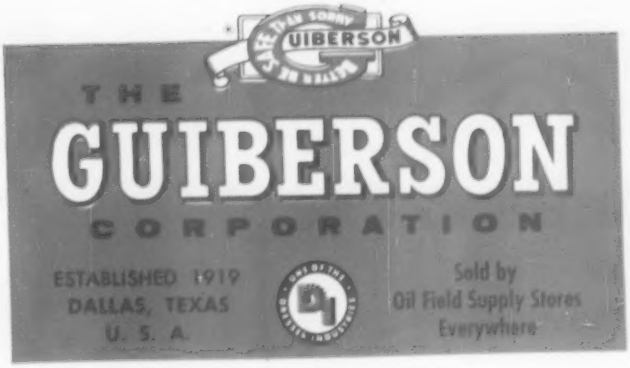
British Representatives of Metals Division: Head, Wrightson & Co., Limited
Canada: Arthur G. McKee & Company of Canada, Ltd., 372 Bay St., Toronto

Swab Costs Too High?

Better Be Safe Than Sorry!

Use Guiberson Swabs!

Our swabs do *good, low-cost* swabbing — in a minimum of time — making them most economical and efficient for *routine swabbing* all sizes of tubing, drill pipe and casing. We have many types of cups immediately available for *specific* and *unusual* swabbing problems.



J&L PRODUCTION FORMULA:

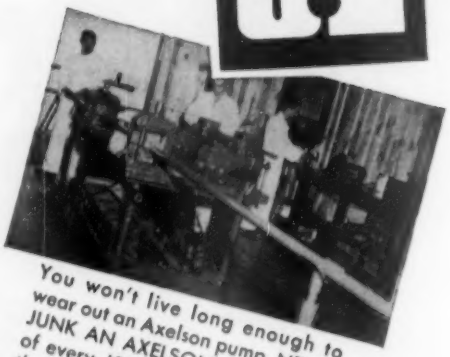
• Lift More Oil • Have Less Trouble

If you have a well you want to pump for more profit, get your J&L store on the 'phone.

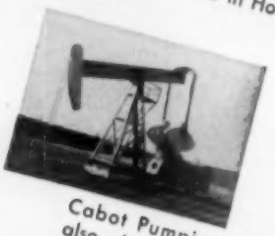
This is not advertising license – we mean business.

We have a string of rods and a bottom hole pump made, in effect, for your well. Axelson equipped and J&L serviced, you'll lift more oil and have less trouble. You'll be pumping for more PROFIT.

Let's discuss this. Get your J&L store on the 'phone!



You won't live long enough to wear out an Axelson pump. NEVER JUNK AN AXELSON is the theme of every J&L pump repair shop in the United States and Canada. This one happens to be in Hobbs, New Mexico.



Cabot Pumping Units also play an important part in the J&L formula for profitable production.

Jones & Laughlin

SUPPLY DIVISION – Tulsa

SERVING THE UNITED STATES AND CANADA

HARD OR NOT —

NOW SCHLUMBERGER CAN CORE IT!

Schlumberger side-wall cores, familiar to every operator in the Gulf Coast and California can now be obtained in the hard-rock areas of the Mid-Continent and the Rocky Mountains.

Recent technical improvements on both the Schlumberger gun and core barrel have made it possible to core many hard-rock formations of 15% or less porosity.

Operations of the Schlumberger Sample Taker is rapid and economical . . . up to 30 zones of interest can be cored on one trip in the hole . . . the cores are 1 – 3/16 inches in diameter and a maximum of 2 – 1/4 inches long.

The Schlumberger sample taker is simple . . . it's safe . . . it's proved by thousands of runs to be the fastest and most dependable way of taking a close look at your production possibilities.

THE EYES OF THE OIL INDUSTRY

SCHLUMBERGER

Well Surveying Corporation

Get Higher Factor of Safety with New VHS Rotary Drilling Lines

• One of the many benefits drillers get with new VHS rotary drilling lines is higher factor of safety. For this new drilling line is 15% stronger than Improved Plow Steel—the strongest grade available before the introduction of VHS.

This means that 10 lines of VHS have a factor of safety 15% greater than 10 lines of the same diameter of IPS. Or, to put it another way, 10 lines of VHS have a factor of safety roughly equivalent to 12 lines of IPS.

TOUGHER, TOO!

New Lay-Set VHS is not only stronger, it's also tougher—and therefore it has higher resistance to peening, and greater resistance to abrasion. Both of these are important factors in maintaining shape and diameter. If regular adaptable cut-off practices are followed, ton-mile advantages should result.

CUT "DOWN TIME"

With new Lay-Set VHS you can drill deeper before increasing the number of parts of line. And VHS's extra strength eliminates, in many cases, any necessity for buying new blocks or regrooving sheaves to use larger diameter lines for higher safety factor.

SIMPLE TO ORDER

You don't need any complicated specifications to order new Lay-Set VHS drilling lines. Just call your Hazard Distributor and tell him the length and diameter you want. He probably has it in stock —or he can get it readily.

for further information write to the nearest Hazard office for Brochure DH-522

LAY-SET VHS

15% Stronger • Tougher •

HAZARD WIRE ROPE DIVISION
American Chain & Cable Company, Inc.

630 McFarland St. Houston 1, Texas | 4555 E. 46th Ave. Denver 16, Colorado | 2216 S. Garfield Ave. Los Angeles 22, Calif. | 400 W. Madison St. Chicago 6, Ill.

Wilkes-Barre, Pa.; Odessa, Texas; New York, N. Y.; Philadelphia, Pa.; San Francisco, Calif.

Pipeliners like Gaso Pumps

P.L. G.P.

Pipe line engineers like Gaso Pumps because Gasos offer such complete assurance of every quality an engineer looks for in pumps. No doubts, worries or uncertainties when the specifications call for the pumps that are *first in their field!*

FIG. 1931—for suction service on large capacity gravity lines and low-pressure large-volume transfer service. Capacities, 291 to 838 GPM at pressures from 225 to 125 PSI.

GASO PUMP & BURNER MFG. CO.
Tulsa, Oklahoma • *EXPORT OFFICE:* 149 Broadway, New York

FIRST IN THEIR FIELD

GASO PUMPS
for every oil industry need

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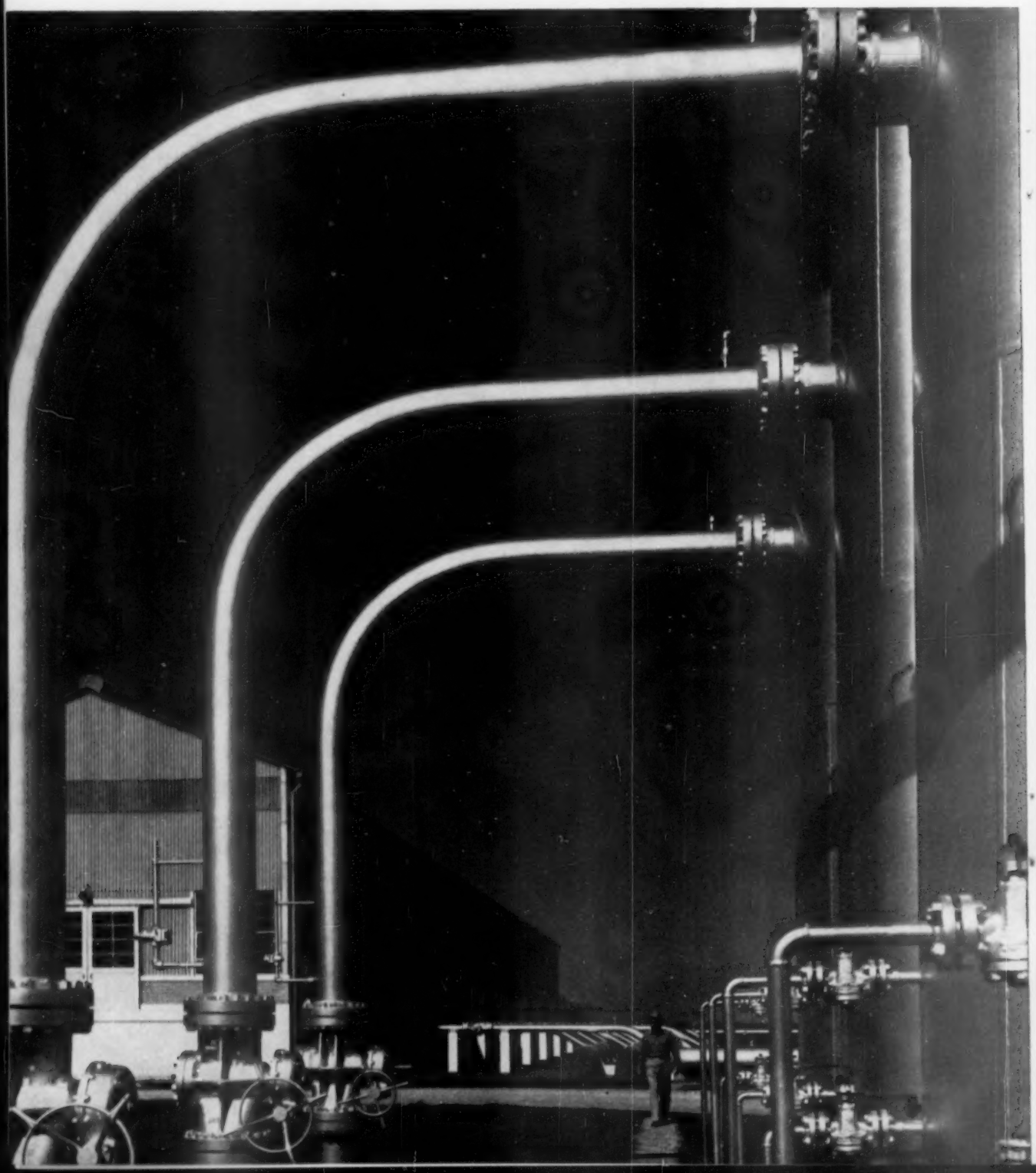
PUMP ENGINEERING CO., Wichita Falls, Texas
LUFKIN FOUNDRY & MACHINE CO., Casper, Wyoming
LUFKIN MACHINE CO., Ltd., Edmonton, Alberta

GET GASO DEPENDABILITY IN WATER FLOODING, TOO

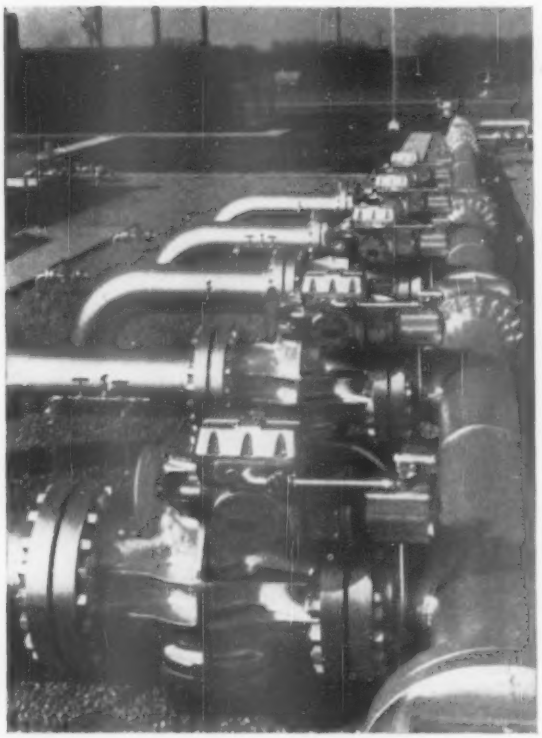
Reliability =

ROCKWELL-Nordstrom VALVES



Profitability

Keep pipelines profitably on stream



Valve down time often plays a large part in the profitability of gas, petroleum and products pipelines. Years of exceptional performance records and cost studies prove that Rockwell-Nordstrom valves are the best way to keep profitably on stream. Here are three reasons why you see so many Rockwell-Nordstrom valves on so many pipelines:

LEAKPROOF SAFETY: Pressurized lubricant sealing eliminates risky "forced" seating . . . prevents internal or external leakage of lightest gases or heaviest liquids.

FAST, DEPENDABLE: Quarter-turn closure . . . lubricant jacking for instant operation . . . power operation is simpler, less costly.

ECONOMICAL: First cost is no higher (often lower) than ordinary valves . . . elimination of metal-to-metal wearing friction and unexposed seats assure low maintenance and long life.

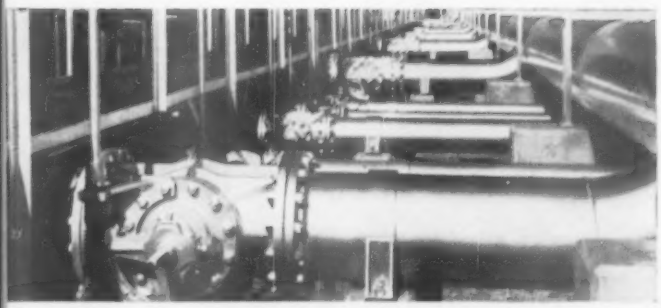
Rockwell-Nordstrom valves are available in a complete range of sizes and pressure ratings in steel, semi-steel and corrosion resisting metals. For more information, see your nearest supplier or write: Rockwell Manufacturing Company, Pittsburgh 8, Pa.

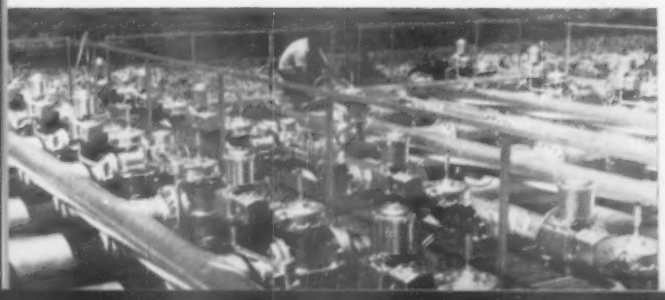
Canadian Valve Licensee: Peacock Brothers Limited

ROCKWELL-
Nordstrom
VALVES

Lubricant Sealed for Positive Shut-off

40th YEAR *of lubricated plug valve leadership*





Reliance
Heavy Duty
Severe Corrosion

Type 5
Heavy Duty
Medium Corrosion

Hi-Ten
Heavy Loads
High Corrosion

you stay out of a hole

Heatreat #1 C M
Medium Duty
Minimum Corrosion

with

D+B SUCKER RODS

that STAY in the hole

Best by test on long runs — trouble-free dependability

Save yourself time and money by installing D+B Sucker Rods—the rods you can forget. They stay in the hole—reduce costly downtime and keep you out of a hole. Made of the very finest, scientifically controlled materials and backed by 50 years of experience, D+B Sucker Rods are available in four types for every well condition. Call or see your nearest Continental or D+B store for full details.

CONTINENTAL
Serving the Oil and Gas Industries

CONTINENTAL SUPPLY COMPANY
A Division of The Youngstown Sheet and Tube Company
General Offices: Dallas, Texas
Representatives in all principal oil fields of the world

D+B
• DEEP WELL PUMPS
• SUCKER RODS
• COUPLINGS

QUALITY IS OUR PRODUCT

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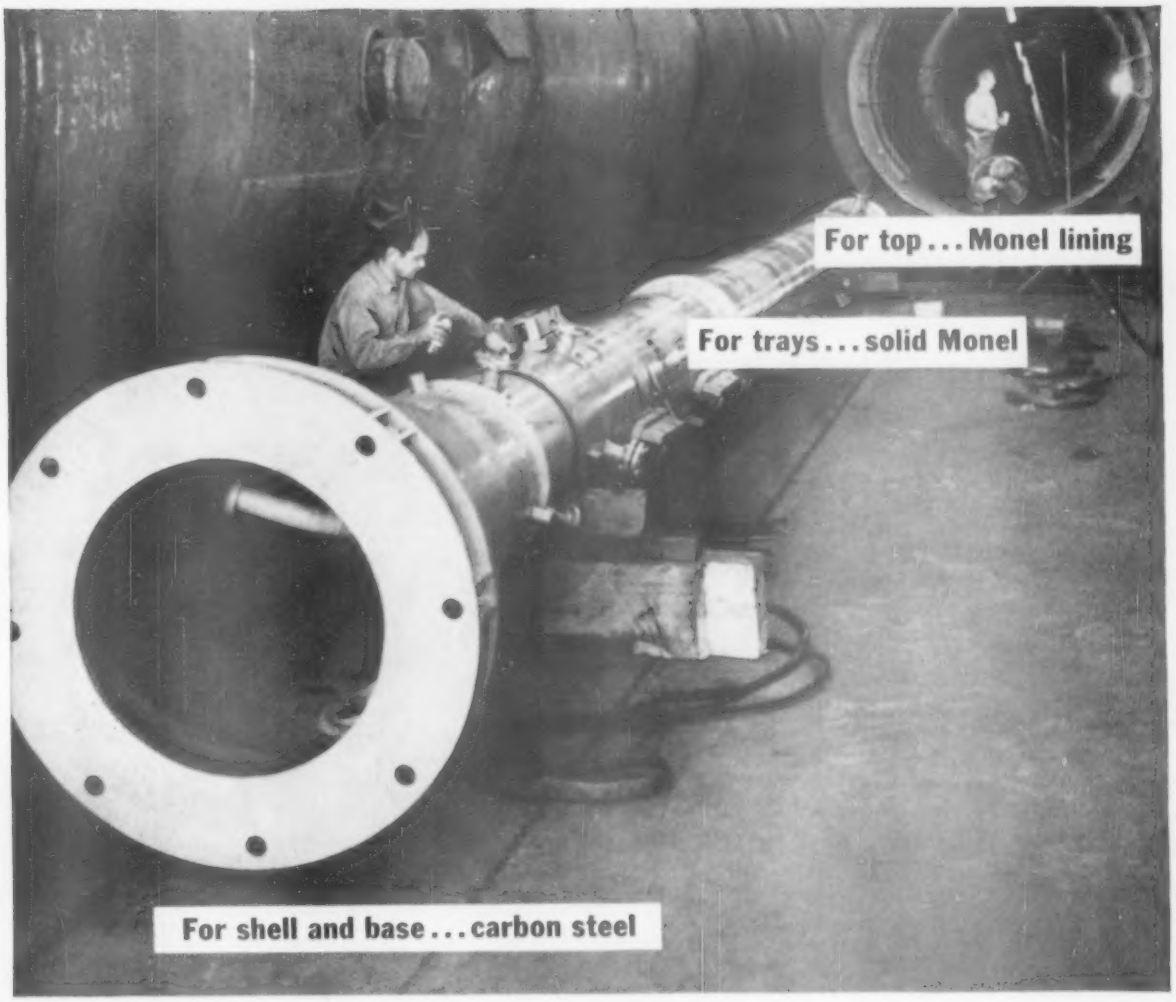
SR 606



Monel combined with steel for economy in new fractionator

The complication in economical tower engineering is corrosion.

How much to accept? What corrosives are present? Where? How do temperature, pressure and stream velocity affect their action? Product clarity requirements? Materials capabilities? Fabricating precautions?

Often, definitive answers to questions like these prove unattainable without great expense. Fortunately, experience has shown a practical way to cut through the difficulty.

Take the tower shown. The company's engineers had experience with Monel* nickel-copper alloy . . . were familiar with its outstanding ability to resist tower-top corrosives . . . aqueous hydrochloric and sulfuric acids, and various salts.

With this in mind, they called on engineers from the fabricator, Fritz W. Glitsch & Son, Inc., for help in pinning down probable corrosion trouble spots. These men, in turn, worked with Inco's Corrosion Engineering Section.

Final "specs" put Monel alloy at each trouble spot, carbon steel elsewhere. Above the probable dew line (the top 15 feet, 6 inches), 3/32-inch Monel alloy lining was used. The eight trays (where agitation intensifies corrosion) were a special Glitsch design done in this same solid nickel-copper alloy.

It's good business to make tower engineering a *team* affair...bringing in the experience of your own engineers and consultants, the fabricator's and Inco's. You are better assured of economical construction and reliable tower operation.

*Registered Trademark

The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

INCO **Nickel Alloys Perform Better, Longer**

Cameron Sales Engineer, W. E. McDonald, demonstrates Hycar-coated seat.

DOUBLE LPG SEAL with Cameron Lift-Plug Valves

A renewable Hycar rubber-coated seat does the trick. The remarkable Cameron Non-Lubricated Lift-Plug Valve seals in both directions with smooth, sure, positive action. This super-tight seal keeps products in place—prevents trouble. One valve (with telltale needle valve in body) replaces two or more ordinary valves which only seal upstream or downstream.

Non-Lubricated means no contamination of line products, no fouling of delicate metering equipment — best of all non-lubricated means no maintenance. Simply set it and forget it.

The seat of the Cameron Non-Lubricated Lift-Plug Valve is separate from and not attached to the body. Body deflections do not affect mating surfaces of plug and seat. Friction is eliminated because the plug is lifted from the seat before rotating — actually never touches the seat except when completely open or closed. Plug and seat may be easily and inexpensively replaced without removing the valve from the line.

As in the case of these LPG Valves with Hycar coated seats, other special materials may be used for special services. If it's a difficult duty — acid, molten metal or the elusive LPG's, Cameron Lift-Plugs are already saving time and money for someone. It could be you.

Cameron

IRON WORKS, INC.

P. O. Box 1212-Houston, Texas

Export Office: 7912 Empire State Bldg., New York City. In England: Cameron Iron Works Ltd., Time & Life Bldg., New Bond Street, London W. 1 England.

They Say—

Wolf in Sheep's Clothing

"Buyers now have enough of a problem negotiating prices because of the Robinson-Patman Act. Imagine the problem if your supplier is prohibited by law from meeting, in good faith, competitive prices of alternate suppliers. If such bills pass, if the interpretations of their proponents prevail, buyers will be thrown into a strange new world of negotiation.

BOATWRIGHT

"HR. 1840 and S. 11 were the latest in the series of bills introduced for this purpose. As you know, HR. 1840 passed the House of Representatives, after a surprise parliamentary maneuver, by the astonishing vote of 393 to 3. S. 11 did not come to the floor of the Senate, so the legislation died upon adjournment.

"It's certain, though, that these or similar bills will be introduced at the next session.

"Such bills are trickily worded—necessarily so, I think, because their authors are at some pains to conceal the essential anticompetitive nature of them. They much prefer to pretend that they are promoting competition even as they are cutting its throat, so they resort to ambiguity.

"Given this type of government control over our business, the consumer will pay the bill in price increases, and they'll be sharp.

"I hope, fervently, that you will do what you can to resist such measures and others like them. The bills sound so innocuous in a quick reading. They are in fact deadly dangerous, for they could drive a knife deep into the very heart of our economy."

John W. Boatwright, chief economist, Standard Oil Co. (Ind.), in a speech before the annual Southwest Purchasing Conference, Fort Worth.

Distinction or Difference

Dear Sir:

On page 65 of the issue of November 5, you note that the phrase "and other minerals" in oil and gas leases has been clarified by the decision of Hon. R. N. Davies, in the U. S. District Court at Bismarck.

You have the facts straight except

WHEN YOU SPECIFY A UNION

➡ LOOK FOR LEAK-PROOF SEALING. With Weco's proven ball and cone design you get a metal-to-metal seating surface unequaled for positive, leak-proof sealing even under the severest conditions.

➡ LOOK FOR FAST MAKE-UP and BREAK-OUT. Weco Unions have precision-cut Acme threads in the female sub and wing nut that make-up easily—break-out quickly—without damage or distortion.

➡ LOOK FOR THE ABILITY TO "TAKE IT." The extra sturdy sub ends, heavier wall construction and stronger wing nuts give Weco extra strength for extra service under the oil field's toughest conditions.

➡ LOOK FOR LONG LIFE. The economy of a union is predicated on service. And because of their many design features and precision manufacturing, Weco Unions last longer—give less trouble—actually cost you less in the long run.

LOOK FOR WECO UNIONS AT YOUR SUPPLY STORE

U-11-56

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

WECO

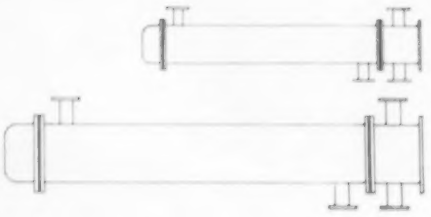
Division of CHIKSAN COMPANY *a subsidiary of* FOOD MACHINERY AND CHEMICAL CORPORATION

fmc

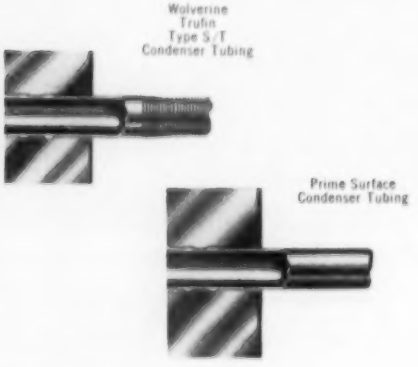
Trufin Opportunities
Number 11 of a series.

4 REASONS WHY WOLVERINE TRUFIN* SHOULD BE USED FOR DEPROPANIZER HEAT EXCHANGERS

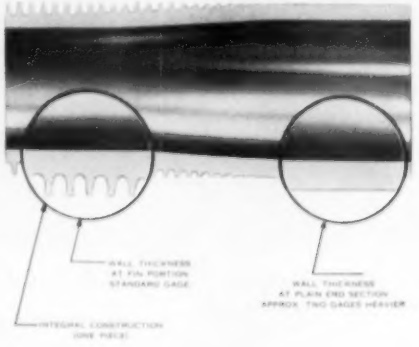
1. Extra Efficiency—Wolverine Trufin Type S/T condenser tube has integral fins—provides more than 2½ times the outside surface of prime surface tubing. You get *more heat transfer per foot of tube with Trufin!*



2. Lower Unit Cost—Users report substantial savings by designing and retubing depropanizer heat exchangers with Trufin. The additional outside surface area permits the use of less tubing for a given heat duty. You get *smaller shells, baffles, reduced fabricating costs, fewer tubes to clean!*



3. Simplified Installation—Trufin rolls into headers as easily as plain tube—using the same methods of fabrication. Standard rolling tools are used. You get *no deviation from existing fabrication procedures.*



4. Designed for the Job—Trufin Type S/T is designed specifically for shell and tube heat exchangers. The cutaway photograph graphically portrays its unique one-piece construction. You get *condenser tubing designed with the stand-up stamina for tough going . . . designed to do a better job, consistently.*

Investigate today—*and save!* Write for Wolverine's Opportunity book. WOLVERINE TUBE, 1449 Central Avenue, Detroit 9, Michigan.

*REG. U.S. PAT. OFF.

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Let's Talk S-C-O-P-E
OF CONDENSER TUBE PRODUCTS

one refinery superintendent asked us . . .

Yes, I can see the cost-saving possibilities of Wolverine Trufin*. But tell me this--

Q. Just how broad is the scope of your activities in the petroleum and petro-chemical fields?

A. We produce heat exchanger tubes in a wide range of metals—copper, copper-base alloys and aluminum. The latter metal is produced in a wide variety of alloys, too. We have a complete range of sizes and can furnish both prime surface and finned heat exchanger tubes. Incidentally, Trufin Type S/T is a natural for shell and tube heat exchangers.

Q. Our bugaboo is salt water corrosion—any suggestions?

A. Our Field Engineering Service is set up to handle questions like this. They'll help you pick the right heat exchanger tube which will best stand up under any corrosion problem you have.

Q. Will this field service help us in other ways?

A. Definitely! The group is composed of tube technicians—each a counsellor in corrosion, fabrication, you name it! They solve tough problems like yours every day.

Q. Run down the list of your condenser tube products again.

A. In addition to Trufin Type S/T and prime surface tubing, there's Trufin in bi-metal—an exterior tube of lightweight, high-finned aluminum and a liner of a metal to suit your particular corrosive condition. This tube works out well where high thermal efficiency is a problem. We call it Trufin Type L/C. Then we produce plain duplex heat exchanger tubes and duplex Type S/T Trufin heat exchanger tubes. A popular combination of metals, for example, is a finned welded steel outer tube with an inhibited Admiralty liner. You might be interested in knowing that we provide a direct mill source of supply for all your U-Bend, fin or plain heat exchanger tubes. All your requirements can be handled directly with Wolverine. And we ship them to you in a box-type disposable pallet so that you can feed them right into the heat exchanger.

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for one thing and that is the lease involved in the litigation was not the lease ordinarily used in North Dakota and it is doubtful if the case sets any precedent for the customary oil and gas leases used in this state.

The particular lease involved did use the wording "and other minerals." However, it went further in that it did provide for royalty payments on different rates than for oil and gas royalties and my understanding of the decision is that it constitutes no precedent for what might be the result on the usual form of lease.

Courts seem to generally hold that oral testimony is admissable in such cases, not to vary the terms of the contract, but to show the intent of the parties. With the variation in the royalties to be paid on "other minerals" it would seem that, viewing the lease as a whole, the intent was to include other minerals not specifically mentioned in the lease.

In the case decided by my good friend Judge Davies, I had reviewed the briefs in connection with a case in State Court, involving the construction of the statute of North Dakota which in effect requires reservation of 50 per cent of "oil, gas, or other minerals," this in connection with the sale of state land where after some years gravel underlying the surface from 6 to 8 in. was sold for road construction by the farmer who purchased the land.

There may be a distinction without a difference but my decision was that under the statute gravel was not included in the reservation. You will remember that Judge Davies is a trial judge and that is also my capacity, both decisions will be appealed.

Judge C. L. Foster
District Court
Fourth Judicial District
Bismarck, N. D.

Investments and Independence

"Canada has never been a recipient of any form of grants or aid, which means that United States investment in Canada of some $11 billion is almost entirely of private origin and ownership.

"The private nature of United States investment in Canada and the significance of that fact to Canada's independence is often overlooked, particularly by foreign observers. For example, I had occasion to speak to many Russians interested in economic affairs on a recent trip to their country, and they simply could not conceive of a country like Canada with so large a United States investment in it remaining free and in control of its own economic destiny. That this is not only possible and feasible but is actually the case

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becomes clearly understandable when the private nature of United States investment is realized.

"... Nevertheless, Canadians are, I think, understandably concerned, not so much with United States participation and control as such, as with the extremely small Canadian participation and voice in shaping the destiny of certain important sectors of their economy. Most American investors seem to prefer 100 per cent or nearly 100 per cent ownership and control. Quite frankly, Canadians look upon this as the great American fetish in the field of international investment. It prevents Canadians from directly acquiring any or more than a token equity interest in Canadian enterprise controlled from the United States."

James Muir, chairman and president, Royal Bank of Canada, in a speech to the Rocky Mountain Oil and Gas Association, Denver.

Taxes, Costs, and Profits

"Congress should recognize the urgent need for a more realistic treatment of depreciation under tax laws so that business can treat as costs those things which are costs while Government treats as profits those things which are profits. Realization of the fact that inflation has utterly destroyed the original intent and purpose of these depreciation provisions has already prompted France, England, and Canada to adopt forward-looking legislation in this field.

"Pending congressional action on this point, inflationary price pressures will be alleviated in many heavy industries by the further issuance of certificates of necessity under the rapid amortization law."

Roger M. Blough, chairman of the board, United States Steel Corp., in a speech before the National Editorial Association, Chicago.

Secondary-Recovery Timetable

"Advantages of secondary recovery can be realized when water flooding or gas injection, or both, become a forethought rather than an afterthought in the exploitation of any pool.

"The oil business is highly competitive—now on a world-wide basis. The opportunity to drill and redrill, to invest and reinvest in facilities is a luxury that competition will not allow.

"The time to begin secondary-recovery operations is as early in the life of a pool as the need for supplementing the natural energy of production is established. The earlier that necessary secondary-recovery operation becomes a part of the primary development, the more profitable the venture will be. Foreign operations can be and are being conducted on that basis. Operations in the United States and Canada are at a disadvantage in that respect."

Herman H. Kaveler, Tulsa petroleum engineering and management consultant, in a speech at the annual meeting of the Independent Petroleum Association of America, Dallas.

A Refiner's Problem

"The industry's narrow profit margins measured in fractions of cents per gallon cannot support grass-roots investment costs of $1,500 per barrel of daily refinery capacity."

W. O. Twaits, executive vice president, Imperial Oil, Ltd., in a speech before the Junior Investment Dealers Association of Canada, Toronto.

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CALENDAR OF EVENTS

NOVEMBER

27-30 American Chemical Society, National Chemical Exposition, Cleveland.

30 Natural Gasoline Association of America, Panhandle-Plains regional

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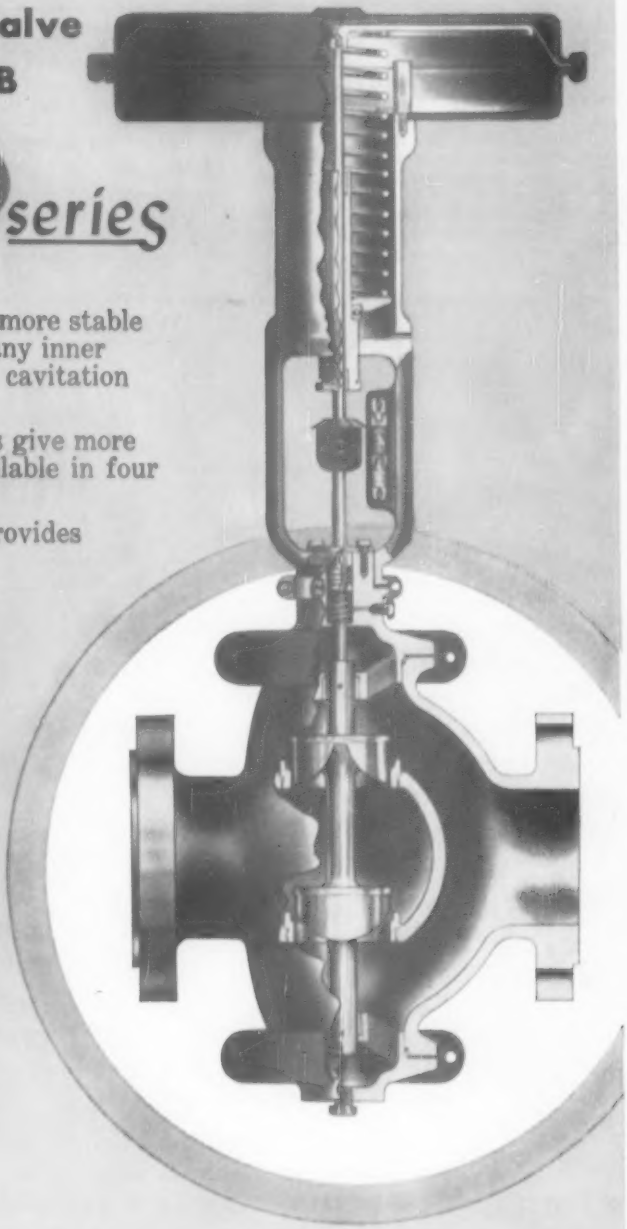
...At The Redesigned Valve Body Of The New BS&B

Super 70 *series*



NEW — Streamlined flow contours provide more stable flow at all rated differentials and any inner valve position. Turbulence and cavitation are minimized.

NEW — Accurately engineered inner valves give more exacting flow characteristics. Available in four types, top and bottom guided.

NEW — Patented all-metal float ring seal provides positive self-actuating closure . . . tightens with the application of pressure.

NEW — Forged clamp ring allows yoke orientation to any position. Requires only two bolts . . . eliminates annoyance of gasket replacements.

Super "70" Series valve bodies are available in three styles . . . single port, double port and split body for use in erosive or corrosive fluid service where easy removability of valve seat is desirable. All bodies can be reversed without change of parts or special tools. Split and bolted stem connector is strong, easily accessible and quickly assembled. Bolted stuffing box assembly with stainless steel follower includes spring-compressed Teflon as standard packing. Steel bodied valve dimensions are in accordance with ASA Standards B 16.5—1953.

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ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

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meeting, Herring Hotel, Amarillo, Tex.

DECEMBER

3-4 New Mexico Oil and Gas Association, annual meeting, Alvarado Hotel, Albuquerque.

3-5 Air Pollution Control Association, national semiannual technical meeting, Rice Hotel, Houston.

6-8 American Petroleum Institute, Oil Industry Information Committee meeting, Biltmore Hotel, New York.

6-8 Interstate Oil Compact Commission, annual meeting, Fontainebleau Hotel, Miami Beach, Fla.

9-12 American Institute of Chemical Engineers, annual meeting, Statler Hotel, Boston.

11-12 Water Quality Control for Subsurface Injection, conference sponsored by the University of Oklahoma, Norman, Okla.

1957

JANUARY

14-16 Pipe Line Contractors Association, ninth annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.

14-18 Society of Automotive Engineers, annual meeting, Sheraton-Cadillac and Statler hotels, Detroit.

17-18 Engineers Joint Council, Statler Hotel, New York.

21-25 American Institute of Electrical Engineers, 1957 winter general meeting, Hotel Statler, New York City.

FEBRUARY

8-9 American Society for Testing Materials, Symposium on composition of petroleum, Jung Hotel, New Orleans.

13-15 National Association of Corrosion Engineers, Tulsa section, eighth annual short course for pipeliners, Hotel Mayo, Tulsa.

22 Natural Gasoline Association of America, Permian basin regional meeting, Scharbauer Hotel, Midland, Tex.

23-25 Instrumentation for the Process Industries, sponsored by Texas A. & M. College, chemical engineering department, College Station, Tex.

24-28 American Institute of Mining, Metallurgical and Petroleum Engineers, annual meeting, Hotels Roosevelt and Jung, New Orleans.

MARCH

3-6 American Institute of Chemical Engineers, regional meeting, the Greenbrier, White Sulphur Springs, W. Va.

6-8 American Petroleum Institute, Southwestern district production division meeting, Statler-Hilton Hotel, Dallas.

11-15 American Institute of Chemical Engineers, regional meeting, Philadelphia.

11-15 National Association of Corrosion Engineers, Kiel Auditorium, St. Louis.

12-13 Subsurface Geology Symposium, fifth annual conference, sponsored by the University of Oklahoma, Norman, Okla.

20-22 American Petroleum Institute, southern district production division meeting, Washington-Youree and Captain Shreve Hotels, Shreveport, La.

25-27 Western Petroleum Refiners Association, annual meeting, Hilton Plaza Hotel, San Antonio, Tex.

27-29 American Power Conference, Sherman Hotel, Chicago.

APRIL

1-4 American Association of Petroleum Geologists, national convention, Kiel Auditorium, St. Louis.

2-4 Corrosion Control, fourth annual conference, sponsored by National Association of Corrosion Engineers and the University of Oklahoma College of Engineering, University of Oklahoma, Norman, Okla.

7-10 Petroleum Equipment Suppliers Association, annual convention, Palm Springs, Calif.

7-12 American Chemical Society, national meeting, Miami, Fla.

10-12 American Petroleum Institute, Mid-Continent district production division meeting, Mayo Hotel, Tulsa.

11-13 American Institute of Mining, Metallurgical, and Petroleum Engineers, Pacific Northwest Regional Conference, Portland, Ore.

14-17 Texas Independent Producers and Royalty Owners Association, Galves and Buccaneer Hotel, Galveston, Tex.

16-18 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, Okla.

16-18 National Petroleum Association, fifty-fourth semiannual meeting, Cleveland.

24-26 National Gasoline Association of America, thirty-sixth annual convention, Rice Hotel, Houston.

24-26 American Petroleum Institute, Rocky Mountain district production division meeting, Gladstone, Townsend, and Henning Hotels, Casper, Wyo.

28-30 Independent Petroleum Association of America, midyear meeting, Buena Vista Hotel, Biloxi, Miss.

29-30 Automatic Control in the Petroleum and Chemical Industries, conference sponsored by the University of Oklahoma, extension study center, University of Oklahoma, Norman, Okla.

29-May 1 Southern Gas Association, annual convention, New Orleans.

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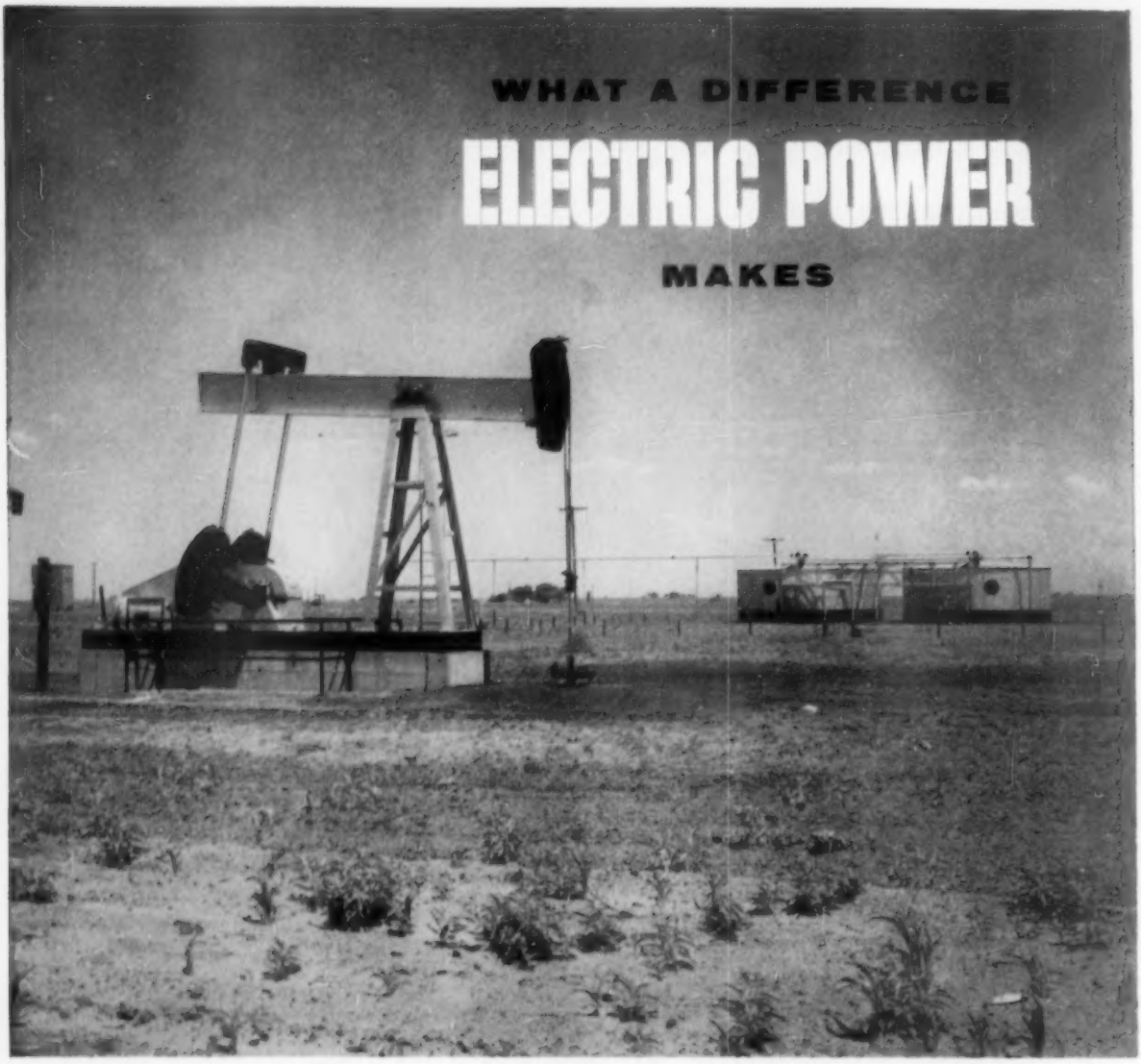

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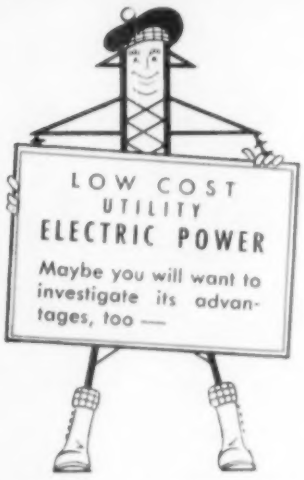

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JOURNALLY SPEAKING . . .

Operatic Operation

ON the night after England and France invaded Egypt and closed the Suez Canal, we were dragged to the local rendition of a musical production named Aida, which, our wife loftily informed us while forcing us to put on a coat and tie, was a famous grand opera written by an Italian named Verdi to celebrate the opening of that same Suez Canal nearly 90 years ago.

Some parts of it weren't half bad, either. The opera didn't seem to have anything to do with the Suez Canal, but we couldn't keep from thinking about Suez anyway. For instance, there was one real nice piece, a sort of a triumphal march, where the hero comes back after conquering all the enemies and capturing a lot of prisoners, and gets flowers thrown at him. We got to wondering whether that was really Sir Anthony Eden up there on the stage wearing those Egyptian kilts, with the Suez Canal in his hip pocket and dragging Nasser in chains behind his chariot.

But then something went wrong. Our knowledge of the Italian language is on the meager side, but as nearly as we could figure out the plot, the hero got mixed up with an Ethiopian in the woodpile. Then everybody got mad at him and the show ended with the hero being thrown into a dungeon to meet a sad end. Again we wondered whether Mr. Verdi was prophetic, and whether Mr. Eden would wind up the same way.

On the way home we were struck with other parallels between ancient and current historical events in the troubled region around Suez. They say that history repeats, but it usually puts a somewhat different twist on each repetition.

For example, as we recall our Sunday School lessons, the Children of Israel got into a lot of trouble down Egypt way several centuries ago. They escaped because waters that are now part of the Suez ship channel parted for them, and then closed up again and engulfed the pursuing Egyptians. Will they be as lucky this time? Or will somebody else get trapped in similar fashion?

The shifting sands of Suez were a world battleground and a crossroads of history long before a ditch was dug through them. Then the prize was spices and silks and the riches of the Orient. Today the prize is oil, and the battles are being fought with oil. Yet, as important as that ditch is to the oil industry, the worst thing that could happen to oil is to have a war fought over it and with it.

Civilization began in the region near the Suez. Will it come to an atomic end there? Is another grand opera, bigger and more tragic than Aida, now on the stage?

The Moving East

THE world's current trouble spot is constantly referred to in press dispatches as the Middle East. But a glance at the map prompts us to ask what happened to the Near East? How did the Middle East get so far West? How East is East, anyway?

There used to be three Easts: Far, Middle, and Near. Far has always pretty much stayed put, but Middle and Near have roamed all over the map, depending on who draws the map. It seems to be dealer's choice. For example, the National Geographic Society, which has some claim to authority, says that the Middle East goes no farther west than Pakistan, while everything from Iran through Egypt is Near East.

That would put the Suez Canal and all the oil-producing countries of that part of the globe in the Near East, not the Middle East. Yet the oil industry has always called that area the Middle East. That probably started because the British, prior to the war, spoke of the Middle East as stretching from Persia through India, and the first oil development in the region was by the British in Iran. But during the war the British Middle East Command expanded westward across North Africa, and war dispatches to American newspapers from as far west as Tripoli were datelined "Middle East."

So it seems that the Near East has disappeared, at least so far as popular usage is concerned, and that the Middle East is now nearer than the Near East used to be. Kipling said that East is East and West is West and never the twain shall meet, but it seems to us that the East—call it Middle East if you want to—is coming mighty close to meeting the West—head on.

—*Henry D. Ralph.*

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Suez will bring a new look at oil policies

SOME fundamental changes in thinking about the oil industry—not only by its customers but by people in it—may result from the current Middle East crisis, even if the crisis passes within a short time.

Consumers both in Europe and the United States are going to think more about the security of their fuels sources. Europe may even swing back toward a coal-based economy for its heavy industry and power generation. Undoubtedly it will seek to diversify the world sources of its oil supply and particularly its oil-transportation routes. The Suez Canal may never again be as important in oil movement.

IN THIS COUNTRY there should be a reexamination of our reliance on imports, not only their total but their source and dependability. This needn't start a drive for complete self-sufficiency, but rather policies to supply the optimum share of the market from domestic sources.

The significance of a reserve producing capacity should take on a new meaning. We have had a rather smug confidence in our assumed ability to increase crude output in an emergency. Now it should be realized that crude capacity alone is not enough.

The excess capacity of such domestic areas as West Texas and the Rockies is of no more immediate value to consumers and refineries on the Atlantic Coast than idle wells in the Middle East. Shut-in inland producers can't help crude-short coastal refineries now because the all-essential transportation links are lacking.

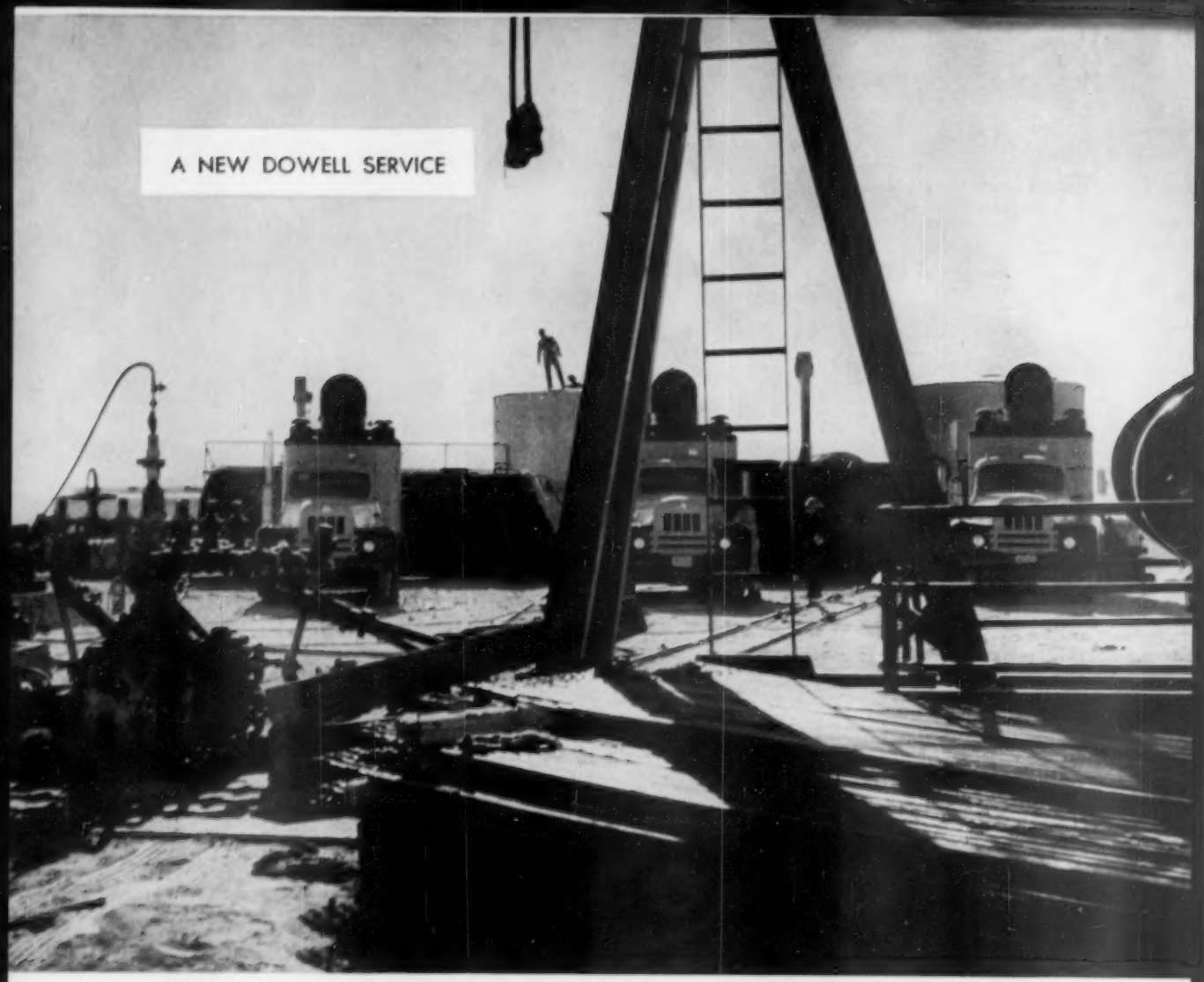
Both for the nation and for individual refiners and marketers, security lies in an integrated system, a going concern, with dependable crude sources linked to markets by adequate, operable transportation facilities. If maintaining a reserve capacity is sound national policy, that reserve should be balanced and spread through all segments of the industry, not concentrated in unconnected crude reserves.

Pipelines can't be moved around like a garden hose. Their need must be assured long before their construction. The reemphasis of this fact should give it more weight in the long-range planning of both the Government and of individual companies.

WITHIN THE INDUSTRY, the current crisis should bring a heightened realization of the mutual interdependence of its segments, and more unity of thought on national policies.

For example, the current imbalance of products stocks makes the gasoline market too weak to support the higher costs of obtaining the increased supplies of crude and fuel oil now needed. So for some time both eastern distributors and southwestern producers must continue to sell off inventories at less than replacement costs.

Suez should bring a new look at all oil policies and problems, a recasting of ideas about the industry's long-range outlook.



High horsepower needed by new Riverfrac treatment is provided by rugged Allison-powered pumping units.

New fresh water treatment fractures oil and gas wells

RIVERFRAC* is a new Dowell treatment for fracturing oil and gas wells. It uses fresh water, with or without sand, as the frac fluid. After outstanding results in gas wells in the San Juan Basin of New Mexico, Riverfrac is now moving into other areas.

This economical treatment is performed by maintaining relatively high injection rates—usually 30 to 65 barrels per minute.

These rates are easy for the Dowell Allison-powered pumping units. Each unit is capable of delivering 613 hydraulic horsepower. And a companion blender mixes 60 barrels of water and sand per minute. You get high horsepower with a minimum of equipment.

Riverfrac provides other advantages in addition to its availability and low cost. The use of water practically eliminates the fire hazard. And addition agents — such as fluid-loss control and surface-tension reducing agents — are available for use in Riverfrac.

For more information or service, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write to Dowell Incorporated, Tulsa 1, Oklahoma, Dept. K-11.

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services for the oil industry DOWELL

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Current and significant in . . .

The Industry This Week

Drilling

• **Two wild wells worlds apart** have been brought under control. Iran's Alborz 5, a sensational wildcat which has been gushing oil since early August, bridged and shut itself in. P. 65.

Union Oil's 5-month-old wild well offshore in the gulf was shut off by a 10,000-ft. relief well. P. 57.

West Coast's first mobile drilling platform is scheduled soon to go to work off Huntington Beach, Calif., exploring a 2-sq.-mile lease held by Monterey, Humble, and Seaboard. It will drill stratigraphic tests to determine sites for drilling islands. P. 56.

Production

• **Water shortage in West Texas** is seriously hampering expansion of big water-flood projects. It costs more money, but operators are turning to long-distance water pipelines and sewage disposal plants to supplement their injection supplies. P. 50.

Stanolind is latest company to install automatic custody transfer system of moving oil from lease to pipeline. Its advantages: Accurate, simple, and compact equipment that's packaged at the factory. P. 52.

Processing

• **The 1957 model autos** carry a familiar tune to refiners. Compression ratios and horsepower are up. That means the engines will need an even higher quality fuel. One bright aspect: The fuel-quality jump will not be as great as 1956. P. 44.

The atomic route for making polyethylene commercially may not be far off. Recent studies indicate that irradiating ethylene to produce polyethylene is technically and economically possible. Key factor: Cost of radiation energy. P. 54.

Exploration

• **Sea mounds in the Gulf of Mexico** are apparently underlaid by salt domes. If this is true, the marginal area of the Continental Shelf holds great promise. Deep-water drilling barges may some day give the answer. P. 58.

Red China is betting $290 million this year on prospects of Karamai field in Sinkiang Province. It hopes the vast drilling and development project will pay off in production of 100,000 bbl. daily by 1962. P. 62.

Sun is stepping up its move into foreign operations with formation of three overseas subsidiaries for Venezuela, Colombia, and Pakistan. P. 65.

Industry

• **More than 10,000,000 bbl. of extra crude** is being moved this month from the Gulf Coast to meet the shortages created by Middle East troubles. Bulk is heading toward oil-hungry Western Europe with a big chunk going to U. S. East Coast refiners charging Middle East crude. P. 66.

Crude price increases—long a goal in the industry—have popped up in two sectors. Union Oil has increased postings for California crude an average of 20 cents per bbl. P. 56. Shell and Creole jumped heavy Venezuelan crude prices from 5 to 21 cents per bbl. P. 67.

Third grade superpremium gasoline is making a hit with Esso Standard customers. Company reports after 6 months third grade has added appreciably to premium sales, had only minor effect on regular. P. 48.

The Picture for 1957 Cars: More Power

	Compression ratio			Maximum horsepower			Piston displacement		
	1957	1956	Change	1957	1956	Change	1957	1956	Change
BUICK:									
Special (Manual)	8.0	7.6	0.4				364	322	42
Special (Dynaflow)	9.5	8.9	0.6	250	220	30	364	322	42
Century, Super, Roadmaster	10.0	9.5	0.5	300	255	45	364	322	42
CADILLAC:									
All except El Dorado	10.0	9.75	0.25	300	288	15	365	365	
El Dorado	10.0	9.75	0.25	325	285	40	365	365	
CHEVROLET:									
Six	8.0	8.0		140	140		235	235	
V-8	8.0-9.5	8.0	0-1.5	162-270	162-170	0-100	265-283	265	0-18
Fuel injection	9.5-10.5			250-283			283		
CHRYSLER:									
Windsor	9.25	8.5	0.75	285	225	60	354	331	23
New Yorker	9.25	9.0	0.25	325	280	45	392	354	38
DE SOTO:									
Firedome	9.25	8.5	0.75	270	230	40	341	330	11
Fireflite	9.25	8.5	0.75	295	255	40	341	330	11
DODGE:									
Coronet (6)	8.0	7.6	0.4	138	131	7	230	230	
Royal	8.5	8.0	0.5	245	218	27	325	315	10
Custom Royal	8.5	8.0	0.5	260	218	42	325	315	10
FORD:									
Six	8.6	8.0	0.6	144	137	7	223	223	
Custom 8	8.6	8.0	0.6	190	173	17	272	272	
Fairlane 8	9.1	8.0	1.1	212	200	12	292	292	
HUDSON:									
Hornet V-8	9.0	9.55	—0.55	255	220	35	327	352	—25
LINCOLN:									
Capri and Premiere	10.0	9.0	1.0	300	285	15	368	368	
MERCURY:									
Custom, Monterey, Montclair	9.75	8.0	1.75	255	210	45	312	312	
NASH:									
Ambassador V-8	9.0	9.55	—0.55	255	220	35	327	352	—25
OLDSMOBILE:									
88 and 98	9.5	9.25	—0.25	277	240	37	371	324.3	46.7
PLYMOUTH:									
Six	8.0	7.6	0.4	132	125	7	230	230	
Plaza V-8	8.0	8.0		197	180	17	277	270	7
Savoy, Belvedere	8.5	8.0	0.5	215	187	28	301	277	24
PONTIAC:									
Chieftain	10.0	8.9	1.1	252	205	47	347	316.6	30.4
Super Chief, Star Chief	10.0	8.9	1.1	270	227	43	347	316.6	30.4
RAMBLER:									
Standard	8.25	7.44	0.81	125	120	5	195.6	195.6	
STUDEBAKER:									
Champion	7.8	7.8		101	101		185.6	185.6	
Commander	8.3	7.8	0.5	180	170	10	259.2	259.2	
President	8.3	7.8	0.5	210	195	15	289	289	
Golden Hawk	7.8			275			289		

New Models Mean Higher Quality Fuel

THIS much is clear about recently unveiled 1957 cars: They will need a higher quality fuel.

The octane needs of the sleek models making their appearance on dealers' show floors, however, will not represent as great a jump as that of the 1956 models.

There are two explanations for this: Smaller gain in compression ratios and diminishing returns from power increases by stepping up compression. In fact this development may signal the beginning of the end for constantly climbing octane numbers.

Arithmetical averages of the more significant information on the 1957 cars show:

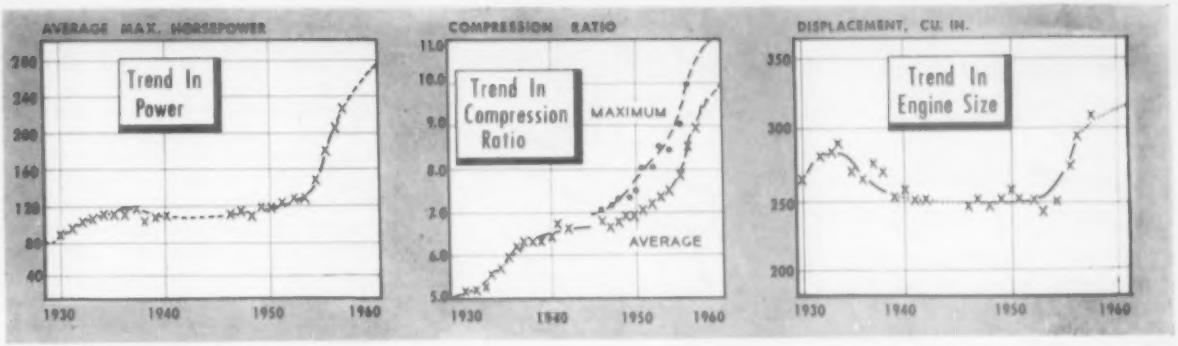
. . . **Compression ratios:** 8.95 to 1. This is an increase of 0.4 compared to last year's increase of 0.59.

. . . **Horsepower:** 232.8. This is up 26 from the 1956 models, which were up 33.7 from the preceding year.

. . . **Displacement:** 304.8 cu. in. This is an increase of 8.1 cu. in., compared with last year's increase of 26 cu. in.

Comparison of the 1957 averages with those of prior postwar years is shown in the small table. Data from 1947 to 1956, inclusive, were taken from Ethyl Corp.'s briefs on passenger cars.

This means that just as the quality of gasoline has had to go up in each of the postwar years, it will have to go up again in 1957. The latest Du Pont survey showed the average premium at 97.1 in October of this year against



96.0 a year before. Regular was 90.2 against 88.8.

Both grades will be up next year, premium probably to 98 and regular to something over 90, possibly even to 92.

Narrowing of the gap between premium and regular is especially significant. While the need for higher grades of fuel in the **new** cars is not up as sharply as a year ago, there is an accelerating need for higher quality fuels for all cars.

Detroit's power race began in earnest in 1953. Its intensity is illustrated by what happened to compression ratios since. In the 5 preceding years the average ratio went from 6.68 to 1 to 7.18 to 1, an increase of 0.5. In the 5 succeeding years it went from 7.18 to 8.95, an increase of 1.77.

What's ahead . . . As the pre-1953 cars disappear from the highways, the average compression ratio of all cars will go up rapidly.

An interesting prediction of what's in store for refiners has been made by Carl Lyons, Du Pont automotive engineer. It indicates that in 5 years the octane requirements for all cars will be up to today's needs for high-requirement cars.

According to this prediction, 99-octane gasoline will be required to meet the needs of 90 per cent of the high-requirement cars of 1957 and 94 octane to meet the needs of 90 per cent of all cars. This is a spread of five points.

By 1961 the same percentage of high-requirement cars will need upward of 102-octane gasoline. And an equal percentage of all cars will need fuel approaching 99 octane. This is a spread of three to four points.

Upgrading regular . . . High premium, extra-premium and superpremium gasolines make the headlines and furnish good copy for advertisements. And while refiners may feel they can't afford to fall behind in the clamor for public attention, the indicated narrowing range may make it more important for them to look to upgrading and increasing the volume of regular than to try for a few more octanes in premium.

The indicated trend toward narrow limits between the extremes of gasoline quality is cited as a factor delaying the entry of other companies into the new "third" grade field.

As the extremes close, the need for three grades is lessened. This argument is sound in theory but whether it will stand the stern test of competition is a horse of another color.

Compression rate . . . Changes in compression ratios in the 1957 cars are highlighted by the move into the 10 to 1 bracket of five makes.

Last year's Packard's Caribbean was the lone model in the 10 to 1 category. This year Buick's Century, Super and Roadmaster, all the Cadillacs, the fuel-injection Chevrolet, the Lincolns, and Pontiac's hydramatic Chieftain, Super Chief and Star chief are all in this class. Packard has not yet displayed its 1957 models but it seems safe to assume that it will not retreat from last year's level.

Extremes in the 1957 models are Chevrolet's fuel injection at 10.5 to 1 and Studebaker's 6-cylinder Champion and its supercharged V-8 Golden Hawk, both at 7.8 to 1. Interestingly, the first and last of these extremes represent the greatest innovations in new models.

Chevrolet is the first to use fuel injection and Studebaker the first to use supercharging on current stock cars. Both will be watched with keen interest. Each represents a possible new direction for motor manufacturers to take as compression ratios and piston displacement near maximum limits.

How Engine Power Grew

(Arithmetical averages of all models)

Year	Compression ratio	Horsepower	Piston displacement
1957	8.95	232.8	304.8
1956	8.55	206.8	296.7
1955	7.96	173.1	270.7
1954	7.64	150.8	267.1
1953	7.44	133.0	256.6
1952	7.18	122.1	249.5
1951	7.07	116.2	247.7
1950	7.03	110.9	245.3
1949	6.88	111.8	249.5
1948	6.73	108.7	247.6
1947	6.68	107.8	248.8

First for Chevvy . . . Fuel injection will be limited at first to Chevvy's sports car, the Corvette.

It is questionable if production of cars using it will exceed 500 per month. Generally looked upon as a sales gimmick, it will certainly be tested thoroughly before it is adopted widely.

Du Pont, working with American Bosch, tested fuel injection on a converted 1954 Lincoln. It found that "at speeds of 45-60 miles per hour, engine power was from 5 to 6 per cent greater than with a carburetor-fed engine. Fuel injection also gave 14 per cent greater fuel economy at 60 miles an hour."

Possible other advantages were mentioned: "Less engine knock, faster pickup, the ability to design smaller engines and to vary engine power without changing the engine size."

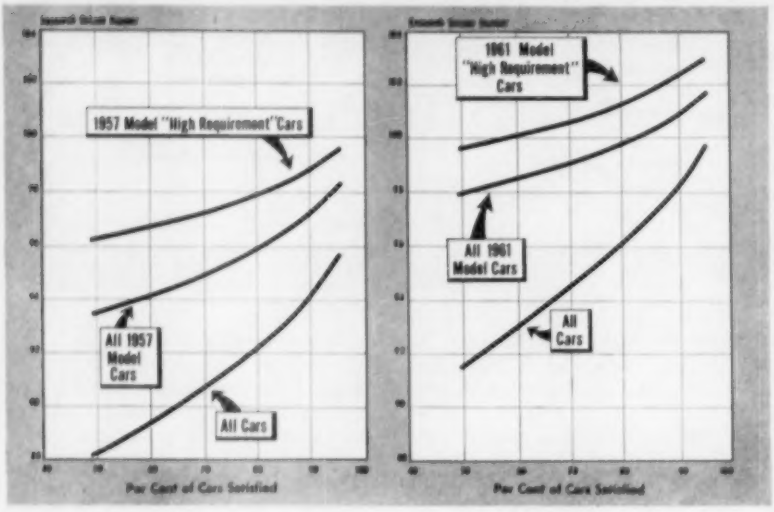
Mercedes-Benz, described as the best engineered sports car in the world, is using fuel injection. U. S. auto manufacturers reportedly have bought 18 of them to study its system.

Mercedes-Benz's repute and Chevrolet's popularity, a combination of the "best-engineered" and the biggest selling cars, may markedly accelerate the adoption of fuel injection. If it does come rapidly, it is not expected to cause any sudden or drastic changes in gasoline requirements.

Some engineers report the octane requirement of a fuel-injection engine tends to be reduced by the lower manifold temperature. It results from the elimination of manifold heat. However, it tends to be increased by the greater intake density caused by lower manifold temperature and turned intake pipes. The net result should be very little change in octane requirements.

The supercharger . . . Studebaker's

Octane Requirements for 1957—and 1961


1957 Model "High Requirement" Cars
All 1957 Model Cars
All Cars
Per Cent of Cars Satisfied
1961 Model "High Requirement" Cars
All 1961 Model Cars
All Cars
Per Cent of Cars Satisfied

introduction of the supercharger on its Golden Hawk is a move in another direction to get more power with less engine.

The horsepower of the Golden Hawk is listed at a high 275. Yet it has the lowest compression ratio of any of the 1957 cars, 7.8 to 1, and a relatively low piston displacement, 289 cu. in.

Its low compression ratio seems to imply a lower octane requirement but this does not necessarily follow. Supercharging has an effect comparable to increasing the ratio with the result that comparable octanes are necessary. However it does make possible greater horsepower from a smaller engine, as the displacement reveals. One of the barriers to general adoption of supercharging is the cost factor. The Golden Hawk delivers in New York at $4,222.93.

Introduction of these devices indicates that today's engine will be further refined before gas turbines or free-piston engines come along to displace it. It looks now that neither will arrive until 1960.

A look at the future . . . Certainly these developments are forerunners of things to come.

There is good reason to believe that Detroit will continue to press for more power in the years immediately ahead. Public, and even political, sentiment aroused by automobile accident fatalities may well be a deterrent. Quick pick-up and better passing ability, both corollaries of greater power, promote safety. If this is told and accepted, the trend toward more power should continue.

In the past this has been achieved largely by increasing compression ratios and piston displacement. Both are that much nearer to absolute limits. The terrific compression increase in the past 5 years, from 7.18 to 1 to 8.95 to 1, was a jump of almost 40 per cent. A like numerical increase in the next 5 years would bring the average up to 11.7 to 1, a rise of 30 per cent.

The ultimate in engine size is governed by physical limitations. Engines can be so big and no bigger. When the power contest began in 1953, it followed a period when there was little change in size. From the end of World War II to 1951, the trend was, if anything, to slightly smaller engines. The average displacement in 1952 was 249.5 cu. in. compared with 248.8 cu. in. in 1947.

Engine sizes started to rise in 1953 and have gone up continuously since. The 1957 average of 304.8 cu. in. is 38 per cent higher than it was 5 years ago. If this rate is continued in the next 5 years, the average would be above 400 cu. in. and the maximum, a conceivable 475 cu. in.

There is still room under the hood for bigger engines. They would give more built-in octanes. As motor manufacturers utilize it more efficiently, there will be proportionately less demand for octanes in gasoline. However, demands on both will continue to grow.

Thus the costly demand for higher and higher octane gasoline may be easing off—but the end is not yet in sight.

Imports Show Suez Confusion

AUSTIN.—Latest reports to the Texas Railroad Commission reveal just how thoroughly plans of importing oil companies were disrupted by troubles in the Middle East.

Several companies reported only their actual imports for October. They explained present conditions make it impossible to make their normal forecasts on imports through next March.

Others reported import totals but emphasized their forecasts were based on normal operations. They added that changed conditions existing from closing of the Suez Canal could mean changes in plans.

The imports . . . Crude imports for the November-March period will average about 835,000 bbl. daily, according to estimates of the companies willing to make forecasts for the period.

Actual imports for October averaged 946,000 bbl. daily. This total included four companies not reporting to the commission last year. If the volume imported by these firms—38,400 bbl. daily—is deducted from the current October total, the remaining portion of reported crude imports is comparable with the figure last year.

The adjusted total amounts to 902,100 bbl. daily, 13 per cent above that reported during October 1955.

Gain in West . . . Most of the net gain in crude imports for October was on the West Coast.

The West Coast total was 179,900 bbl. daily for October this year for the companies reporting both this year and last. The total was 92,500 bbl. daily for the same month last year. This means a gain of little more than 87,000 bbl. daily or 94 per cent.

Reported imports for all other areas amounted to 722,200 bbl. daily last month. They were 702,700 bbl. daily a year earlier. The gain was about 19,500 bbl. daily or 2.8 per cent.

Products steady . . . Imports of petroleum products will be affected only indirectly by the Suez Canal closing.

Reason for this is simple. Residual fuel accounts for most of the total imports. This material comes from the Caribbean area and not through the Suez.

Company estimates of product imports for the November-March period are about 17 per cent greater than actual imports by these companies for the year earlier.

If demand for heavy fuel in Europe this winter starts heavy bidding for the available fuel in the Caribbean area, prices may move high enough to cause some shifting to coal on the East Coast.

Imports, Exports Both Drop

SMALL decreases were reported for both imports and exports in September by the Census Bureau of the Department of Commerce.

Total imports averaged 1,385,600 bbl. daily compared with 1,395,000 bbl. daily in August. The all-time record was 1,582,900 bbl. daily set last December.

Other significant totals and changes shown on the September report are:

... **Total crude** averaged 954,300 bbl. daily, down 117,500 bbl. daily from the record set in July. The September total was the lowest since April.

... **Crude from Mexico** was at the lowest level since November last year.

... **Venezuelan crude** showed a gain over August but was 55,900 bbl. daily below the record set in July.

... **Imports of Middle East** crude averaged 273,600 bbl. daily, the lowest since last February.

... **Residual imports** topped receipts for the same month last year by 38,700 bbl. daily. But the average for the month was only 59.3 per cent of the record total, set last January during the heating season.

... **Imports of other products** averaged 82,000 bbl. daily, the highest level for the past 12 months.

... **Total exports** of crude and products, excluding shipments to territories, averaged 309,500 bbl. daily compared with 331,200 bbl. daily for the previous month and with 324,600 bbl. daily a year ago.

IMPORTS INTO CONTINENTAL UNITED STATES
(Thousands of barrels)

	Sept. 1956	Aug. 1956	Sept. 1955
Crude—			
Mexico	310	649	707
Colombia	886	981	491
Venezuela	14,107	13,521	12,007
Ecuador		125	72
Peru	245		
Trinidad	111		
Kuwait	4,366	6,406	4,397
Saudi Arabia	1,801	1,676	2,374
Neutral Zone		306	
Iraq	860	696	652
Iran	657	173	395
Qatar	524	1,330	858
Canada	3,567	3,839	1,846
Far East	1,195	1,324	968
Total crude	28,629	31,026	24,767
Daily average	954	1,001	825
Products—			
Residual fuel	10,480	10,376	9,318
Other products	2,460	1,843	2,463
Total products	12,940	12,219	11,781
Daily average	431	394	393
Total all oils	41,569	43,245	36,548
Daily average	1,385	1,395	1,218

EXPORTS*

	Sept. 1956	Aug. 1956	Sept. 1955
Crude	805	1,179	870
Gasoline	2,580	2,121	2,269
Kerosine	58	90	144
Distillate	2,170	2,066	2,179
Residual	1,522	2,215	2,189
Lube oils	1,041	1,239	1,148
Other products	1,110	1,358	938
Total all oils	9,286	10,268	9,737
Daily average	310	331	325

*Excludes shipments to territories.

New Tool Measures Corrosion Rate Quickly

LONG BEACH.—Corrosion engineers now have available a new tool for studying corrosions, an electrical method which measures the loss of metal from a probe installed in the system being studied.

The highly sensitive method is based on the fact that as corrosion converts metal into salts electrical resistance increases. Thus, by means of a meter circuit, this change in resistance is translated directly into units of corrosion.

In describing the new technique before a regional conference of the National Association of Corrosion Engineers here, G. H. Rohrbach, Crest Instrument Co., pointed out that readings are essentially independent of the temperature and nature of the corrosive medium.

They also are made directly on the metals being studied without removal of the probe from the system. Likewise, since the instrument responds to the resistance of the exposed sensing element as a whole, the resistance measurement has an averaging effect and gives the same kind of data as is obtained by weight-loss measurements.

Field tests described . . . Rohrbach said the corrosimeter was used to pinpoint corrosion in the power oil system of a hydraulic pumping installation.

A probe installed on the suction side of the power oil pump showed a corrosion rate of about 30 microinches per day. By excluding air from the settling tank it was found that corrosion could be reduced to a negligible value.

Speed with which the tool determines corrosion rates was illustrated by studies made in the amine system of a natural-gasoline plant.

Within 35 hours a probe study showed that a corrosion rate of 2.6 microinches per hour existed in the amine still. This checked closely with a rate of 2.3 microinches per hour calculated from a micrometer and caliper survey—which required 18 months to complete.

FPC Gets a Puzzler

American Louisiana, Gulf issue before commission

WASHINGTON. — The question of whether a conditional gas sales contract can be withdrawn while a pipeline-expansion application based on it is pending before the Federal Power Commission is squarely before the FPC this week.

The question arose during hearings on the proposed expansion of American Louisiana Pipe Line Co. To support its proposal, the firm submitted five contracts with Gulf Refining Co. for the supply of approximately 100,000,000 cu. ft. of gas daily.

As hearings on the application opened November 14, Gulf indicated it would withdraw four of the contracts under a clause permitting either party to cancel if the FPC had not approved the deal in 6 months. The conditional period expired on that date.

Gulf's motion was strongly opposed by counsel for American Louisiana, who asserted there were other provisions in the contract which effectively killed the conditioning clause.

As a result of this development, the trial examiner recessed the hearings indefinitely and sent Gulf's motion to the full commission for consideration. Under FPC rules, a party to a proceeding may withdraw only with the commission's consent.

There was no immediate indication of the position Gulf would take if the FPC rules against it.

American Louisiana's application called for the construction of 36 miles of new pipeline and the addition of 46,000 compression-horsepower to increase its line's capacity from 300,000 to 400,000 M.c.f. daily. The project had an estimated cost of $16,000,000. The four contracts Gulf proposed to withdraw covered 80 to 90 per cent of the gas on which the plan was based.

Also involved in the case is Panhandle Eastern Pipe Line Co.'s application for permission to end the sale of 127,000,000 cu. ft. daily to Michigan Consolidated Gas Co., an American Louisiana affiliate.

Michigan Consolidated was to get part of the additional gas carried by American Louisiana. Panhandle contended that this new source would give Michigan Consolidated an adequate supply.

Will superpremiums stick?

. . . Esso Likes Third Grade

ESSO STANDARD is well satisfied with the results of Golden Esso Extra. The superpremium gasoline, now a little more than 6 months old, has added appreciably to the company's premium sales with only a minor effect on regular.

Now that Golden Esso Extra has been introduced to 75 per cent of the company's customers and has had a chance to settle down to a more normal role, Esso Standard finds that:

. . . **Total premium sales** have increased by 4 per cent;

. . . **Sales of the superpremium** gasoline represents 10 to 15 per cent of the total gallonage;

. . . **Eighteen per cent** of those who tried Golden Esso Extra had been buying competitive brands;

. . . **One of three customers** who tried it are sticking with it;

. . . **Drivers of newer cars** buy the bulk of the new brand. Seventy-one per cent drove 1955-56 cars;

. . . **Expensive cars** are taking the greater portion of Golden Esso Extra. Sixty-one per cent of those who tried it were drivers of high-priced cars;

. . . **Six out of ten** of the drivers of high-priced cars who tried it kept on using it;

. . . **Improved public opinion** for Esso is reflected in surveys which show that the public credited the company with being the first to offer this type of improved product.

Consumers agreed generally on two points: greater power and faster acceleration, and better mileage.

The increase of 4 per cent in overall premium sales is particularly significant in the case of Esso since its premium sales run well above the industry average.

Nation-wide, the industry average has been running an estimated 43 per cent premium and 57 per cent regular. Esso's percentages are somewhat the reverse, averaging closer to 60 per cent premium and 40 per cent regular.

What others are doing . . . Reports from other firms selling superpremium gasoline indicate varying results:

. . . **Humble Oil & Refining Co.,** which markets Esso gasoline in the Gulf Coast region, says that its Golden Esso Extra accounts for about 6 per cent of its total retail sales in the area where the new gasoline is marketed.

. . . **Continental Oil Co.** has not yet released results of surveys on its "royal super" sales; however, a spot check of Houston stations selling the new superoctane fuel brought widely varying reports, with greater sales in higher-class residential areas, and lower sales at industrial-area outlets.

. . . **Watson Oil Co.,** an independent marketer, which put the superpremium gasoline on sale in mid-November, admitted that sales were "not too good yet."

. . . **Cities Service Oil Co.,** latest major entrant in the superpremium field, introduced its 100-plus brand in selected cities late in October. Company officials feel that it is too early yet to give any conclusive answers.

Esso is optimistic . . . The octane number of Golden Esso Extra has not been disclosed but it is reported to be 102, presumably according to the Weise method.

This places it well above the highest of the general premium gasolines and makes it fully capable of satisfying the needs of today's highest requirement cars.

Esso's surveys indicate that many of the owners of 1957 cars will be in the market for Golden. The weighted average compression ratios of 1957 cars is expected to be close to 9 to 1 and a dozen of the new models are in the 10-to-1 class. New-car purchasers have shown a disposition to believe in a need for the highest quality gasoline available.

Since new car sales are forecast at 10 per cent higher for the 1957 models and since they are of generally higher requirement status, the outlook for Golden Esso Extra is brightened.

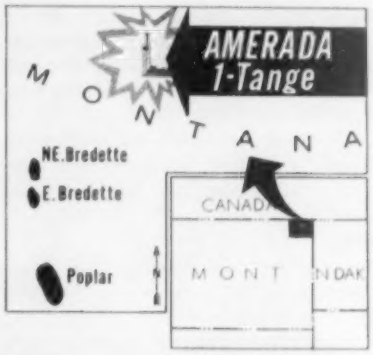
Humble, which reported that sales of Golden are higher at stations in middle and upper income districts, said that the increased compression ratio of new cars has increased interest in the superpremium grade.

Esso claims to have met both the original targets set up when the new brand was introduced last May. It would be available to 75 per cent of Esso customers by October 1, and it would represent 10 to 15 per cent of their total gasoline sales.

Esso markets through approximately 25,000 dealers in 18 states and the District of Columbia, from Maine to South Carolina and west through Tennessee to Arkansas and Louisiana.

Reaching 75 per cent of its customers does not mean 75 per cent of the stations carry the Golden Esso Extra. It does mean that sufficient stations, including all large gallonage outlets, do carry it to supply 75 per cent of the company's customers.

Conversion of these stations was the biggest cost factor in introducing the new brand. No total cost or cost-per-station figures are available. The cost per station varied considerably, ranging from the relatively simple replacement of a new pump to extending bays and manifolding and adding pumps and tankage.



Williston Discovery

Tests at Montana strike indicate commercial pool

BISMARCK, N. D.—The most important U. S. Williston discovery news since Antelope field was opened earlier this year came out of Montana last week. Amerada Petroleum Corp. has set casing at its 1 Tange in Sheridan County in the extreme northeastern part of the state.

The well flowed oil on a drill-stem test at 9,050-9,230 ft. in the Silurian at an estimated 20 bbl. of fluid per hour, 70 per cent of it oil. At the end of a 5-hour test the flow was nearly 100 per cent oil.

Closest production in the Williston basin is at Northeast Bredette field, 29 miles southwest. Success at 1 Tange would open production in Sheridan County and move Montana's Williston production to its most northeasterly limit.

Big Gas Line Near Midpoint

SAN FRANCISCO.—Pacific Gas & Electric Co.'s $10,000,000 expansion program for its 34-in. gas line from Topock, Ariz., to Milpitas, Calif., is near the halfway mark. A 38½-mile section between Gilroy and Milpitas and ground preparations for a 25-mile section farther south have been completed.

A total of 85 miles of 34-in. pipe is laid along three portions of the 502-mile Arizona border-to-Bay Area line. The project also includes boosting com-

pressor station capacities and a 1,080-ft. bridge across the Colorado River to connect the P.G.&E. line with El Paso Natural Gas Co.'s line at Topock.

When the project is completed early next year, P.G.&E.'s line will have a capacity of 750 million cubic feet daily. Further additions are planned by P.G.&E. to boost that figure to 1,025,000,000 cubic feet by 1958.

Products Line Set

Wood River-Chicago line to move 90-100,000 bbl.

FINDLAY, Ohio. — Ohio Oil Co. plans to build a common-carrier products line, with ultimate capacity of 90,000 to 100,000 bbl. per day, from Wood River, Ill., to Chicago.

J. C. Donnell, II, president of Ohio Oil, said pipe is on order and detailed plans of the project are being completed. Starting date depends on pipe delivery, which may not be completed until 1958.

Purpose of the 350-mile, 12-in. line, Donnell said, is to alleviate the bottleneck through the Alton, Ill., locks during low-water periods in the Mississippi and Illinois rivers. It will also make additional space available to move products directly from the Mid-Continent to Chicago. Ohio will lay a 12-in. line to link the new artery to its 40,000-bbl. refinery at Robinson, Ill.

Products could be tendered from numerous other sources including:

... **Existing lines** coming into the Wood River-East St. Louis area. The Cherokee and Phillips Petroleum Co. products lines tie into the Ohio terminal there.

... **Refineries** in the area. Major refineries nearby are operated by Shell Oil Co., Socony Mobil Oil Co., Inc., Standard Oil Co. (Ind.), and Sinclair Refining Co.

... **Barges** coming up the Mississippi.

Shell and Phillips now operate products lines from the area to Chicago. But much of the traffic is handled by barge. And uncertainties caused by low water and the winter freeze have long invited the construction of a new pipeline to lessen dependence on river movement.

Initial capacity has not been decided, the company said. It will depend on how much throughput is lined up. No firm commitments have been made.

Ohio and Shell also have products lines from Wood River east to Indianapolis. Ohio will lay a 6½-mile connection from its line to another common carrier in the Indianapolis area. This will permit shipments from Wood River to Indianapolis, east to the Lima, Toledo, and Columbus areas in Ohio.

watching WASHINGTON

. . . with Bertram F. Linz

Labor—a jet-age pace . . .

THE Oil, Chemical, and Atomic Workers International Union program for a $112-$117 weekly wage and 30-hour week by 1970 *(The Oil and Gas Journal, November 12, page 126)* may be revised—upward—before that objective is reached.

Organized labor's next target will be a 50 per cent increase in hourly wages. But this increase will be based on the 40-hour week, making it considerably greater as hours are reduced.

The present average wage in all industry is $2 an hour and substantially higher in oil refining and production. The AFL-CIO economic policy committee has sighted its guns on a $120 weekly pay envelope as an "average." If oil-industry wages maintain their present relationship to the average, it would figure out close to $150.

The labor committee says it took about 15 years to get a 50 per cent increase in wages from $1.33 to $2. It won't take so long to get the next 50 per cent, it warns.

This time, with a stronger trade-union movement, the job can undoubtedly be accomplished far more quickly, it says.

The high cost of research . . .

THE oil industry ranks high in both research spending and results. Only three industries spend more of their own money on self-improvement or get greater results in the way of patentable developments.

The Justice Department has just completed a survey of industrial and federal research as part of its study of economic factors which might tend to cut competition, lead to monopoly, or injure small business. These inquiries are called for in the Defense Production Act.

The exact amount spent on research can't be pinpointed, Atty. Gen. Brownell told Congress in his report. In some cases, he said, it is charged to initial production costs. But he estimates that private industry is spending $3 billion a year and the Government $4 billion.

Such figures as are available place the oil industry's research cost at $137.6 million in 1953 and the Government's studies at $8.2 million. Only the chemical, machinery, and electrical industries spent more of their own money.

Oil had the same standing of fourth in the field of patents. It owned 18,700 and had applications pending for 8,100 more.

As might be expected, the large companies in every industry account for the larger part of the research and resultant patents. In the oil industry, companies with 5,000 or more employes spend four-fifths of the money used on research and hold well over two-thirds of the patents.

Pay as you drive . . .

MOTORISTS will kick in well over $500,000 to help pay for the new highway program during the present fiscal year.

This figure showed up when the Treasury Department reported last week that revenue from the gasoline tax topped the billion-dollar mark in fiscal 1956 for the first time.

Gasoline-tax revenue, based on the old rate of 2 cents per gallon, totaled $1,030,383,000. That was an increase of $75,000,000 over the $954,818,000 received in fiscal 1955. The rate was raised to 3 cents last July 1, with the additional revenue to go into the highway fund.

There are three other federal taxes on petroleum which added another $135,000,000 to the Government's take from that source.

Receipts from the 6-cent tax on lubricating oil were $74,584,000 against $69,818,000 in 1955. The 4½ per cent tax on pipeline transportation brought in $35,681,000 against $33,458,000. And the 2-cent tax on diesel fuel returned $24,464,000 against $22,692,000.

PEGASUS WATER-FLOOD project is one of the largest in West Texas. Expansion at injection plant (above) depends on getting more water.

West Texas Needs Water

- As drought continues, new projects are being held up and expansion is lagging in big producing area
- Texas needs 125 billion barrels of water to produce the 10½ billion barrels of oil reserves recoverable by water flooding
- To meet the problem, operators are turning to costly water pipelines and sewage filtration systems

Robert J. Enright
Southwest Editor

MIDLAND.—There have been lots of jokes about the shortage of water in West Texas.

But oil operators in this immense arid region don't find them very amusing.

The oil industry is West Texas' biggest water user, with the possible exception of combined municipal consumption.

As such, it is suffering from a lack of water which has steadily worsened during the past several years. This applies not only to fresh water but to brackish or briny water in porous underground formations.

Water flooding is the big reason for oil's voracious West Texas water appetite. And the demand for flood water is spiraling. Secondary recovery and pressure maintenance by water flooding is a relatively new thing in West Texas, having really begun in a big way only in the last 3 or 4 years.

Few fields in the region are blessed with efficient natural water drives. Most produce via solution gas drive and, without pressure maintenance, will give up only a small portion of their oil.

Water flooding is still regarded as the best method, viewed from both efficiency and economy angles, of hiking the oil take from most of these pools.

Huge demand . . . Experts recently estimated Texas reserves recoverable by water flooding at about 10½ billion barrels.

A rough rule-of-thumb is that it takes 10 to 15 bbl. of water to recover 1 bbl. of oil.

This would mean that the industry, to recover this secondary oil, will need 100 to 150 billion barrels or 4½ to 6½ trillion gallons of water. By far the largest chunk of this need will arise in West Texas.

Operators will be hard put to find so much. In fact, they're already feeling the pinch.

Big water bill . . . Some planned floods are being delayed. Some pilot projects, though proved some time ago, aren't being expanded. Where operators have found an adequate supply of water, it sometimes has been a costly proposition to get it where it's needed.

This is especially so for the growing number of pressure-maintenance projects in West Texas' really big oil fields.

In the huge Goldsmith field of Ector County, the Goldsmith San Andres Unit is injecting roughly 60,000 bbl. of water daily. In operation for 2 years now, the 18,400-acre project has injected about 40,000,000 bbl. of water.

But it had to go a long way to get it. The brackish water is coming from wells completed at 3,500 ft. in the Hendrick reef 30 miles away near Wink in Winkler County. It reaches Goldsmith through an 18-in. pipeline. Pumping equipment to get it there and treating facilities to make it suitable for injection inflate the water bill further.

Pilots hung up . . . Other big projects haven't as yet whipped their water-supply problems and are still looking for adequate sources.

In Midland County, expansion of pilot floods in two big fields is being held up while operators look for water.

These are the unit-operated floods of the Pennsylvanian formation in the giant 16,000-acre Pegasus field unit straddling the Midland-Upton county line, and in the 10,800-acre Parks field about 10 miles to the north.

The pilot projects in both fields presently get water for injection from wells drilled to the San Andres formation at about 5,000 ft. In both cases, the supply is inadequate for a full-scale flood.

In both the Pegasus and Parks projects, injection has proved effective in hiking oil output, stabilizing pressure, and cutting gas-oil ratios.

Parks field . . . At Parks, the unit had injected 1,140,000 bbl. of water as of September 1 through the four inputs in the single five-spot pilot in the Bend section of the Pennsylvanian at 10,400 ft. Water injection was started in February 1955.

So far, 8 of the 10 key producing wells in the pilot area have received allowable increases. All had been penalized heavily prior to start of water injection.

The total allowable of the 10 observation wells, which by late spring of 1955 had fallen to a minimum of 319 bbl., was back up to 686 bbl. daily in September. The pilot area's maximum gas-oil ratio reached 15,000:1 in June 1955. By September it had been cut to a much more reasonable 3,500:1.

Meanwhile, the allowable in the remainder of the field fell from 2,010 bbl. daily in February 1955 to 950 bbl. daily. Bottom-hole pressure in the pilot area has stabilized and increased slight-

ly, while it is still dropping steadily in the rest of the field.

The Parks unit has 45 producing wells, plus the four inputs.

Pegasus field . . . In Pegasus the response to water injection in the Pennsylvanian has been similar. The results have not been quite so good but are still very favorable.

The pilot here has 12 input wells on a five-spot pattern in the center of the field. There are 90 Pennsylvanian producers in Pegasus.

The Pegasus unit still is evaluating a test flood in the field's Ellenburger zone at 13,000 ft. This is the deepest flood ever undertaken. Water is going into the pay through one input well on the eastern edge of the field.

If the test proves out, a peripheral flood of the entire zone will be launched. Results so far have not been as favorable as in the Pennsylvanian.

To capitalize on the bright prospects indicated by the Pennsylvanian pilots, the unit will have to find lots more water than it can get from the present San Andres source. If the test in Ellenburger, the biggest pay zone of the three, proves out, still more water would be needed.

Sewage as source . . . Recently, Magnolia Petroleum Co., as Pegasus Unit operator, took an unusual course to try to round up more water.

The company approached the city of Midland, 20 miles north of the field, for an option to buy the effluent from the city sewage treatment plant. It offered to pay $25,000 for a 1-year option on a 10-year contract guaranteeing a minimum of $40,000 annually.

Magnolia said it has yet to determine whether it would pay the unit to treat the water and pipe it the 20 miles to the field before exercising the option.

Magnolia thinks a plant, including filtration system, and pipeline to the field would cost the unit more than $1,500,000.

On top of the initial cost, the unit would pay the city 5 cents per 1,000 gal. the first 5 years of the contract, 6 cents for the second 5 years, and higher rates for any added time.

The company also offered to permit the city to reserve the first 1,000,000 to 1,500,000 gal. daily for use on its parks or municipal golf course. It would charge the city 3 cents per 1,000 gal. to treat this water.

So far the city hasn't acted on the request for the option.

More to come . . . Other large new floods have been approved by the Texas Railroad Commission for the same general area, including the North Midland Farms field in Andrews County, Shipley field in Ward County, and others.

Others are in the planning stage. Headlee and Dora Roberts, Devonian pools of Midland and Ector counties are among them. These pools recently were cut to 6 producing days on the operators' own motions to give them time to plan and execute floods before plunging bottom-hole pressures dropped too low.

So water demands will continue to snowball.

Shell Seeks Sewage Water

STERLING, Colo.—Shell Oil Co. is attempting to buy sewage discharge water from Sterling to carry on secondary recovery in the Mount Hope oil field 15 miles northwest of the town.

Shell has asked the City Council for an option on up to 38,000 gal. of water daily at ¼ cent per barrel for the next 5 years. The firm indicated it might extend the period to 25 years if the deal could be worked out.

Council members, however, refused to guarantee clear title to the water and balked at committing the town to a long-term contract which, they estimated, would net only $2.50 per day. Shell was asked to submit a new proposal involving use of more water. Sterling discharges about 600,000 gal. of water into the South Platte River daily.

Operators hope for a sympathetic attitude and possibly some aid from state and local authorities. They point out that state and local economies will gain from every barrel of secondary oil produced—through taxes, added oil company spending, and larger payrolls.

This was effectively pointed out at a recent "Water for Texas" conference at College Station, by Paul D. Torrey, Austin petroleum engineer and chairman of the secondary-recovery and pressure-maintenance committee of the Interstate Oil Compact Commission.

Torrey estimated that 680,000 bbl. daily of the average 2,801,316 bbl. daily of oil produced during 1955 in Texas came from water-flood projects. An estimated total of 852,631 bbl., he said, came from water, or gas, or combination injection programs.

From this water-flood oil, state and local governments are netting about $100,000 a day in tax revenue. From the 10½ billion barrels of flood oil thought recoverable, the state and its citizens can expect to get $1,500,000,000, Torrey said.

"The prosperity that the use of water in the production of oil will bring to Texas is a compelling reason why any plan for the utilization of water in the state will be incomplete if it does not include consideration of the water requirements of the oil industry."

Pressure for Steel Expansion Mounts

WASHINGTON.—Pressure for a new steel expansion program to support the boom in tanker building and provide for new pipelines and other oil projects stiffened last week.

Oil men complained that plans for new lines were held up because of the possibility that pipe might not be available for several years, and shipbuilders said the lag in deliveries of plate is limiting tanker construction.

Some shipyards reported that steel plants are 20 per cent behind on orders. The lag may reach 40 per cent if the steel industry doesn't do something about it, they warned.

Basis of their complaints is the charge that mills are basing their set-asides on 1954 demand. At that time, they said, there was little shipbuilding.

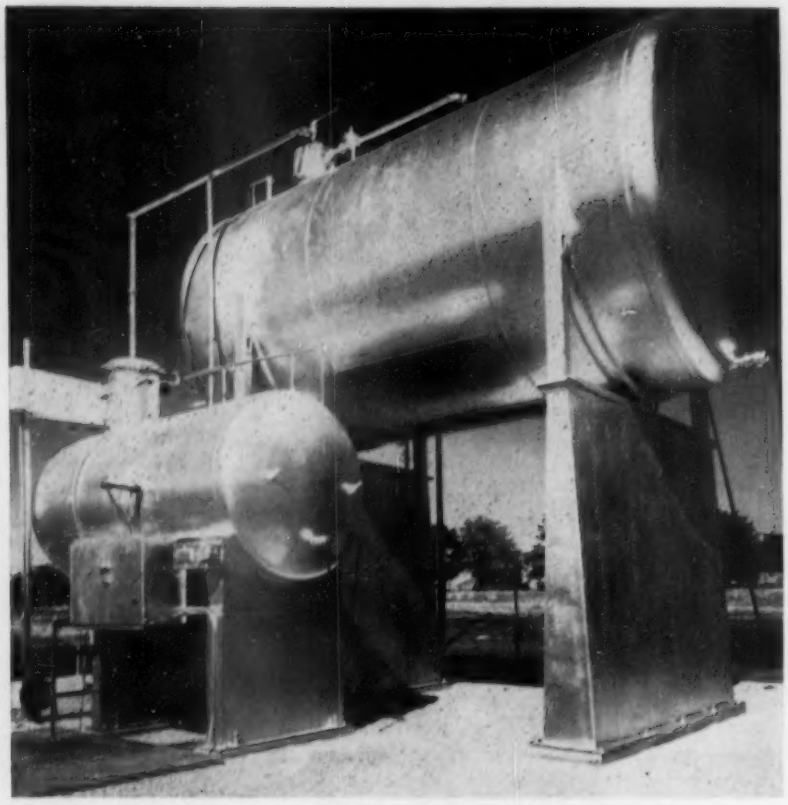
Maritime Administration officials, who have proposals for the building of more than 30 tankers before them, were confident the problem will be ironed out. In other government quarters, studies of steel supply and demand were speeded up with the hope of determining before the end of the year whether a new round of steel-plant building is needed.

Steel interests are ready to go ahead with the building of $1.5 billion or more of new plant if the Government resumes the granting of accelerated tax amortization, according to projects filed with the Office of Defense Mobilization. These projects would include new facilities for both plate and pipe.

Tanker prices jump . . . The Maritime Administration, meanwhile, learned that prices for warbuilt T2 tankers are edging close to what they cost the Government to build more than a decade ago.

The upward trend was noted in bids opened by the Maritime Administration for the sale of six tankers reacquired from the Niarchos interests by Justice Department action. More than 40 offers were received, with prices ranging up to $2,400,000. The vessels, which cost the Government over $3,000,000 each, were originally sold after World War II for $1,800,000 and less.

Decision as to a new steel-expansion program will depend on the Defense Department's report of estimated requirements for full mobilization. The report is due to be written within the next 3 to 6 weeks.



GRAVITY FLOW feeds crude from tank to metering vessel. It's that simple (almost) as . . .

Lease Goes Automatic

Stanolind battery in regular operation; it's accurate, simple, and compact—and it's packaged at the factory

TULSA.—A pneumatically controlled automatic custody transfer system which can be purchased from the factory as a complete package is running crude to pipeline on regular schedule for Stanolind Oil & Gas Co.

It is operating in Sholem Alechem S. W. field in Carter County, Oklahoma, feeding crude into Service Pipe Line Co.'s lines on a 24-hour basis. The unit has been making test runs since its installation last April. Three other fields are scheduled to get the system soon.

Described by Stanolind as "simplified" and "unique," the unit has only two principal components. It uses a 400-bbl. elevated storage tank, a 60-bbl. metering tank, and a series of gas-operated and float-controlled automatic valves.

The system can be set for continuous runs for any length of time. "Bad" oil and other undesirable components are separated out and only good-quality crude is dumped into the lines. Here's how it works:

. . . **Crude passes through** separator into main tank. A pre-set 31-day clock starts the day's run by opening the inlet valve to the metering tank, which fills by gravity flow.

. . . **Level reaches upper float,** closing inlet valve to metering tank. Outlet valve to pipeline opens, oil temperature is recorded and totaled, and an oil sample is stored in a small tank.

. . . **Metering tank empties** into pipeline and a counter registers a 60-bbl. delivery. Outlet valve closes, the inlet valve to metering tank opens, and the operation repeats itself.

If there is less than 60 bbl. of oil in the main tank, the flow to the metering tank stops while the main tank takes on more crude. When the crude level is high enough, the automatic process is set off again.

Quality of oil is controlled by a battery-powered electronic water-cut detector. It can be arranged automatically to divert bad oil through the treater or shut down the lease if quality drops below minimum standards.

The advantages . . . Stanolind's system is powered by gas pressure, making it completely mechanical and entirely independent of outside power sources. It is not affected by weather, severe storms, power failures, or malfunctioning switches.

Stanolind says the unit differs from others in that it is simpler, less expensive, assembled at the factory, and requires no electrical power. The company claims these features result in greater dependability and accuracy.

The amount of salable oil is increased appreciably since the unit can store, measure, and run oil at pressures of 12 psi. And the net result is a cleaner operation all around.

Pumpers and gagers make only one or two visits a month to the tank battery. They mix stored samples of oil with a gas-driven motor mixer to determine average gravity and sediment content of the oil that has run since the last check.

The continuous-run feature of the Stanolind unit offers more efficient use of pipeline facilities. Instead of running once or twice a day in peak loads, the battery spreads deliveries out in uniform loads over a 24-hour period.

This feature gives pipeline companies a break, also. It permits them to run considerably more oil in a given period of time and makes it possible for them to save money on new lines to serve automatic custody transfer leases. Such lines could use smaller-diameter pipe and fittings.

The savings . . . Stanolind's unit, which can be turned out on an assembly-line basis, is less expensive than most, the company points out, and installation and maintenance costs are less. A pumper can handle many additional leases.

The savings carry over into accounting, too. One run ticket does the job required of dozens under the conventional crude transfer system. And tank tables can be eliminated, along with excess tankage, while efficiency and accuracy increase.

On larger leases, one automatic unit can replace several conventional batteries. In many cases, conventional tankage can be torn out and sold for enough to pay for installation of the automatic unit.

Other locations . . . Stanolind has plans to install the units at Slaughter field in West Texas, Hastings field on the Texas Gulf Coast, and Elk basin in southern Montana.

The company cautions that the device is not practical for all locations—at least for the present—but Stanolind looks for it to take over rapidly at

GAGER THIEFS oil from small sample-storage vessel instead of storage tank. Samples are taken only once or twice a month, but good-quality crude is guaranteed.

many locations now operating under semiautomatic conditions.

The key, Stanolind says, is "economic factors," which have to be considered separately for each operation. This is mostly involved with cutting down costs of labor, maintenance, and depreciation. On new leases, installation costs would be a factor.

McColl, Regent May Merge

TORONTO.—McColl-Frontenac Oil Co., Ltd., has approached Regent Refining (Canada) Ltd. with a merger offer which will involve the exchange of shares in the two companies. Both Canadian companies are now controlled by The Texas Co. which owns a 59 per cent interest in McColl and a 90 per cent interest in Regent.

The suggested stock exchange would be on the basis of 6 common shares of McColl for each 19 shares of Regent. McColl-Frontenac operates a 13,000-bbl. per day refinery at Edmonton and a 58,000-bbl. plant at Montreal East. Regent, formerly Trinidad Leaseholds, Ltd., has a 14,000-bbl. per day refinery at Port Credit, Ont., near Toronto.

When Texaco acquired Trinidad Oil Co., Ltd., last September, the transfer included the Canadian subsidiary, Regent. McColl maintains producing properties in Canada and Trinidad, the latter through its wholly-owned subsidiary, Antilles Petroleum Co. (Trinidad), Ltd.

McColl's offer is made contingent on stockholder approval at a special meeting to be called.

Pipeline BRIEFS

Sun Pipe Line Co. has started up its new 109-mile, 14-in. products line from Twin Oaks, Pa., near the Marcus Hook refinery, to Sun's marine and land terminal at Newark, N. J. The $6-million line and $500,000 terminal expansion will make Newark Sun's principal shipping point for products to New York and New England markets.

Line capacity is 83,000 bbl. per day of gasoline or 65,000 bbl. per day of furnace oil. This is double that of the old line which the 14-in. replaces. The old 8-in. line is being taken up.

Canadian Bechtel, Ltd., which already has a 110-mile spread on the Trans-Canada gas pipeline, has received the contract for a second spread. It extends 54 miles from Portage LaPrairie to Winnipeg, eastern terminus of the 574-mile western segment of the Alberta to Montreal line. Price-Poole of Canada, Ltd., received 99 miles from Miniota east to near McGregor. Price said it hoped to complete stringing before suspending operations until spring.

El Paso Natural Gas Co. will add a 170-mile microwave radio relay link to its system, extending the utility's network to some 1,000 miles. The installation will provide voice communication and telemetering circuits between El Paso offices at Flagstaff, Ariz., and Gallup, N. M.

Westspur Pipe Line Co. plans to expand its crude system in southeastern Saskatchewan to increase throughput ultimately more than 60,000 bbl. daily. The company has asked the Board of Transport Commissioners for permission to build 20 miles of 12-in. from Alida south to the Carnduff-Glen Ewen area to tap Cantal, Hastings, Florence, Carnduff, and Glen-Ewen fields. There would be 34 miles of 4, 6, and 8-in. gathering lines in these fields.

An oil-based chemical which has had phenomenal success in saving farm crops from disease has come home to serve the industry which fostered it.

Called Vancide 89 by Esso Research & Engineering Co., the developer, the fungicide is proving successful in stretching the life of vinyl tape used to wrap pipelines. It kills off bacteria and resists moist underground conditions. It's also good for paints and a variety of plastic articles. The technical name for the product is N-trichloromethylthio tetrahydrophthalimide.

Consumer's Gas Co. of Toronto nearly doubled its natural-gas deliveries for the fiscal year ended September 30. This year the total was 9 billion cubic feet. Last year, it was 5 billion and the year before that, the last in which manufactured gas was sold, it was 4 billion.

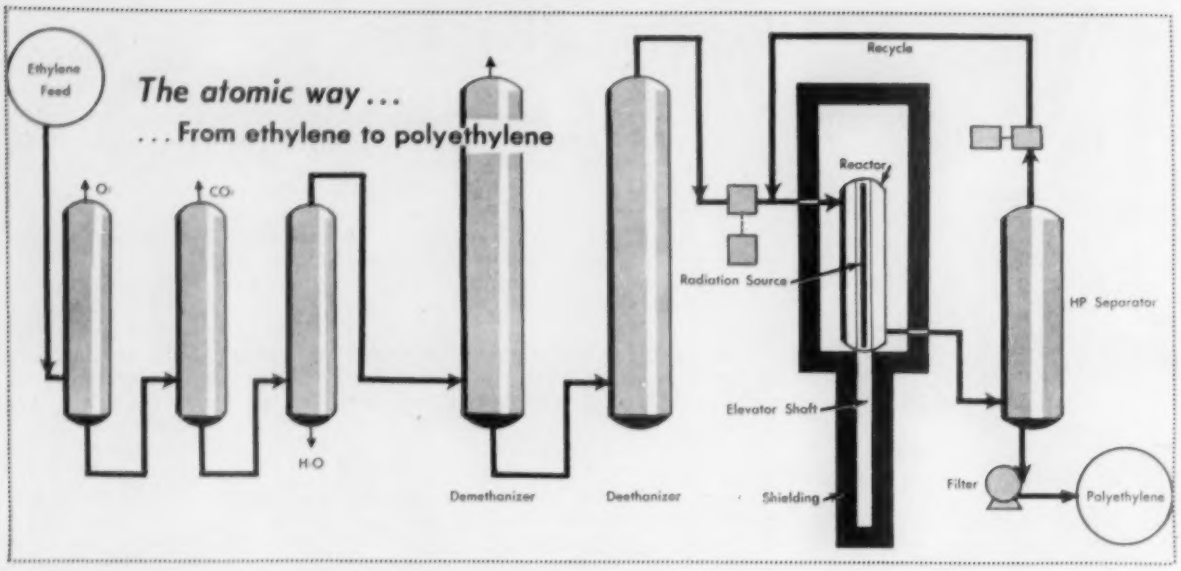
The increase is attributed chiefly to three voluntary reductions in the 19 months since natural gas was introduced by the company and the addition of 13,000 home-heating customers and many commercial and industrial establishments to its sales roll.

Ohio Oil Co. has completed 10 miles of 8-in. crude line from its Durkee station to the Bonanza station north of Worland in Wyoming's Big Horn basin. Contractor was W. E. Glaycomb, Cody, Wyo. The new line will move 14,000 bbl. per day of Bonanza crude from the field to Durkee station where it will go into Ohio's existing system.

Also for Pipeliners . . .

FPC faces decision on whether conditional gas sales contract can be withdrawn while a pipeline expansion application is before the commission (P. 47) . . . P.G.&E. nears halfway point on 34-in. line (P. 48) . . . Ohio Oil outlines plans for a 12-in. products line from Wood River to Chicago (P. 49) . . . Pressure is building up for an expansion in the steel industry (P. 51) . . . Service Pipe Line now getting crude from newly designed automatic custody transfer unit in operation for Stanolind Oil & Gas (P. 52) . . . NATO is taking bids for a 275-mile products line in northwestern France (P. 67).

PLUS THESE TECHNICAL FEATURES: Polyethylene plastic tape wraps 122 miles of 22-in. line in Michigan and Ohio (P. 70) . . . How to plan a microwave radio-relay system (P. 82) . . . Microballoon sealing foam in cone-roof working tanks cuts evaporation losses (P. 91) . . . Pipeline Patrol's construction tables (P. 104).



Commercial Atomic Processing Nears

George Weber
Refinery Editor

MAKING polyethylene by irradiating ethylene is a routine feat—in the laboratory. The day may not be too far off when the same trick will be accomplished commercially.

In fact Joseph J. Martin of the University of Michigan claims the radiopolymerization process may already be "in the ball park" from a commercial standpoint. He is a member of the university's Department of Chemical and Metallurgical Engineering which has made a study of possibilities.

One factor holds the key to successful competition of the process with old-line thermal and catalytic methods. It is the cost of the radiation energy required to trigger the reaction.

Economic studies already completed scaled up successful laboratory investigations to commercial proportion. They produced some outright estimates of the extent to which byproduct radiation from nuclear reactors may be available for such commercial uses.

It is generally conceded that radiation energy eventually will come into its own. This will occur after problems of designing and operating single-purpose reactors for power or plutonium have been resolved. What it may cost is a subject of conjecture at this point. The views of Martin and his fellow workers thus are to be construed as "educated guesses" rather than firm predictions.

Success in the lab . . . The possibility seen for this new departure in chemical processing stems from an intensive study of radiopolymerization of ethylene at Ann Arbor.

Under a contract with the U. S. Atomic Energy Commission, investigations were carried out in the Fission Products Laboratory of Michigan's Engineering Research Institute.

Gamma radiation was employed to promote the reaction. It was confirmed that irradiation of ethylene at room temperature and pressures ranging from 200 to 3,000 psi. produces a solid polymer. Its characteristics were similar to those of the commercial product.

Product yield was dependent on the strength of the radiation field and the time of exposure. But encouraging yields showed that the rate of reaction is rapid enough to justify looking further at commercial possibilities.

Thus radiopolymerization of ethylene falls into the category of a reaction which is triggered by radiation energy and proceeds thereafter without excessive radioactive energy requirements. This type of reaction is now being investigated in numerous petroleum laboratories to find out what other processes may be initiated by this energy.

Proposed process . . . In a tentative report before a recent Tracerlab-sponsored symposium, Martin outlined a potential commercial radiopolymerization process.

A medium-sized plant to produce 60,000 lb. of polyethylene per year was selected.

Raw materials came from petroleum cracking processes and was first concentrated by conventional means. A high-purity ethylene is required. This is because other constituents of refinery light ends are known to interfere with the radiation-triggered reaction.

The heart of the proposed plant design is a series of annular reactors. Each measures 4½ ft. o.d. and 30 ft. in length. A smaller concentric cylinder of 1-ft. diameter accepts a radioactive source. It can be raised or lowered from a shielded storage well beneath the reactor.

This annular design makes maximum use of radiation by surrounding the source with reactant which is continuously circulated through the vessel. Solid polymer formed in the reactor can be removed in slurry form by liquid sprays, which also remove heat of reaction. Water or cyclohexane may be used, since neither shows any interference with the reaction.

The effluent then passes to a high pressure separator. The unreacted ethylene is recycled from here to the reactors. Conventional filtering, drying, melting, extruding, and pelleting of the solid polyethylene completes the process.

The proposed unit comprises 72 reactors in parallel, encased in heavy shielding. Since material exposed to gamma radiation does not itself become radioactive, the reactor bank can be entered with safety when the source is lowered into the shielded wells.

The reactor design is simple, and its practicality is assured. Careful calculations have been made of radiation intensity required to energize the poly-

merization reaction at the proposed flow rates of feed plus recycle.

Radiation sources . . . Having determined design and standard cost estimates on a reasonably firm basis for a plant of this size, the group then tackled the problem of radiation cost.

Here they readily admit to estimation, for accurate predictions are impossible at this time.

Three possible sources were considered. Each would provide the 430,000,000 curies required for a plant of this size. Handling and shipping material of this high activity would be costly. So the plant should be located adjacent to a nuclear reactor.

Spent fuel elements from a power reactor could be used. This possible source has a short half-life. Elements from a reactor are so radioactive that they must be set aside to decay before they can be handled economically. Hence, it is reasonable to assume that this material might be available at a power reactor on a rental basis. Since its commercial use would coincide with the period during which it would otherwise remain in costly shielded storage, the rental should be nominal. Two or three such fuel elements each decaying from 10^5 to 10^6 curies in 80 days would suffice for a plant of the proposed size. An estimated cost of venting and handling one fuel element is placed at about $5,000, with replacement once every 2 months.

Fission products represent another possible radiation source. With a half-life of about 2½ months, this source might be available at a reactor in concentrated form for roughly 1 cent per curie. About every 23 days, 20 per cent of the fission product would need to be replaced to prevent its decaying below the required radiation level.

The third radiation source under consideration was cesium-137. This radioisotope has an extremely long half-life of 33 years. But its cost would be very high, probably about 50 cents per curie. Handling costs would be minimized. But at the 50-cent price, this radiation source would be uneconomical.

How about costs? . . . An investment cost of $14,100,000 is assumed for a complete plant less the radiation source plus $5,000,000 for contingencies and working capital.

Original radiation investment then ranges from a little over $1,000,000 for spent fuel elements to about $4,320,000 for fission products. Cesium-137 at the 50-cent price would add $215,000,000 to original investment.

On operating costs the depreciation, maintenance, overhead, raw materials, sales, administration, labor and utilities would be comparable for all three radiation sources. Taxes, insurance and interest, all related to investment cost, would loom high for the cesium-137 source. The other two sources would show lower, comparable figures. On the other hand, radiation replacement for fission products would run more than six times as high per year than that for spent fuel elements. No charge-off would be made for the cesium isotope because of its long half-life.

With the stated assumption on unit cost and replacement for the three sources, some interesting unit manufacturing costs per pound of polyethylene were derived. Use of cesium-137 would boost unit cost to about 60 cents per pound. However, fission products could be used at an over-all cost of about 47 cents per pound. Spent fuel elements would further reduce this figure to about 27.5 cents per pound.

Cost qualifications . . . The investment and operating figures presented by Martin and his associates are carefully qualified as exploratory in nature.

As the government and private reactor programs progress in this country, the assumed bases for estimating costs of making polyethylene by radiation will doubtless change.

Paul C. Aebersold, director of the A.E.C.'s Isotope Extension Division of Civilian Application, found agreement for his views on radiation usage at the symposium. He said that the next 10 years should see an era of "applied radiation." Radioisotopes will become a major source of radiation energy for promoting chemical reactions, food preservation, drug sterilization and product improvement. The impression was shared by symposium members. They predicted that as availability widened, isotope costs should decline. Isotopes may become bargains by present standards.

The radiation age also was foreseen by Clarke Goodman, the A.E.C.'s assistant director of reactor development. He and other speakers at the 3-day meeting predicted that the multipurpose reactor would definitely come into the picture. When it does, radiation which is now considered an unavoidable nuisance in piles built to make power or plutonium, will become a usable by-product. The vast radiation energy which will be developed in nuclear reactors planned for the near future, brings the 430,000,000 curie requirements of the proposed polyethylene plant into practical focus.

When technical know-how reaches the stage where these vast radiation energy sources may be tapped, additional methods may become feasible. Spent fuel elements, fission products and radioactive isotopes will continue in the picture. But direct irradiation of a circulating stream of reactants in the pile itself may also become practical. Another possibility is the circulation of a radioactive "carrier" stream between the atomic pile and processing reactors installed in an adjacent unit.

Whether radiopolymerization of polyethylene will ever prove economic on the basis discussed by Martin and his associates, remains to be seen. But it is given a fair chance by those sufficiently close to civilian nuclear developments to hazard a look into the future.

Radioprocessing for other petroleum fractions may follow. The groundwork is now being laid in the research projects aimed at finding whether other refining reactions can be as successfully triggered by radiation, as ethylene polymerization.

New Plant, Process

Big petrochem factory will be first user of oxidation

CHICAGO.—A new oxidation process which Standard Oil Co. (Ind.) acquired late last year will find its first commercial application in a 60,000,000-lb. per year petrochemical plant to be built by the affiliated Amoco Chemicals Corp.

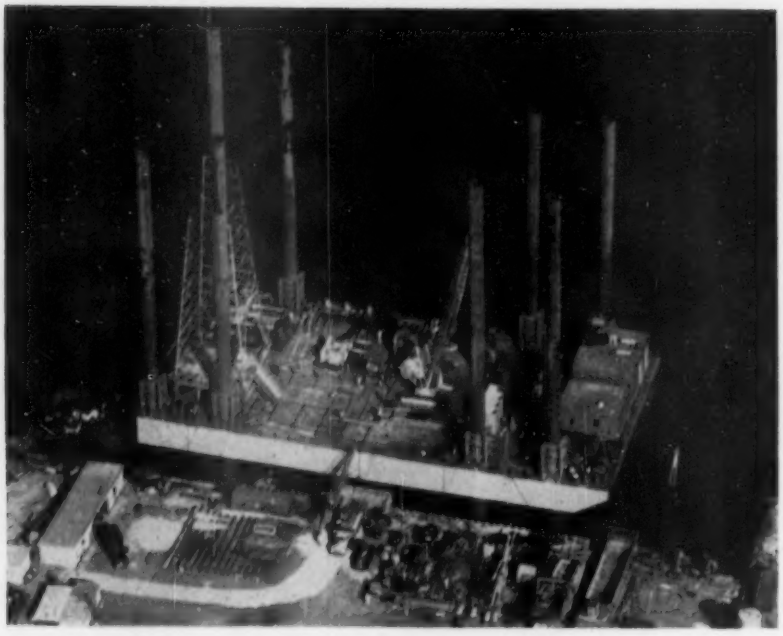
The plant will be located in the Midwest, probably at Whiting, Ind., where feed stocks are available from Standard's 220,000-bbl. refinery.

Amoco will make a number of products by the new process, including phthalic anhydride, isophthalic acid, terephthalic acid, dimethyl terephthalate, dimethyl isophthalate, and benzoic acid. The plant will cost over $10 million. Construction is scheduled to begin early next year, with initial operation sometime in 1958.

The oxidation process, acquired from Scientific Design Co., Inc., of New York, is an improvement over conventional processes of its type in that it will permit the production of a diversified line of chemicals from a single raw material, petroleum-derived aromatics *(The Oil and Gas Journal, December 5, 1955, page 75)*.

What it does . . . While details on the process have not been revealed, it is known to produce phthalic anhydride by oxidation of orthoxylene, and terephthalic acid from paraxylene. It is thus independent of coal-tar naphthalene, the traditional source of these chemical intermediates, and promises to raise the status of petroleum aromatics in the chemical field.

Standard of Indiana has world-wide exclusive rights to the process.



Hoopla ends, work starts for . . .

West's First "Gulf" Platform

LOS ANGELES.—The West Coast's first gulf-type drilling platform was formally commissioned November 17 at Terminal Island in Los Angeles Harbor.

It will go to work as soon as finishing touches are added to a program of blocking out a 2-sq.-mile lease held jointly by Monterey Oil Co., Humble Oil & Refining Co., and Seaboard Oil Co. a mile offshore from Huntington Beach.

Monterey, as operator for the group, will drill a series of stratigraphic tests to determine possible locations for artificial drilling islands similar to the one they are now using at Seal Beach.

The $2,000,000 mobile drilling platform, designed and built by Offshore Constructors, Inc., will operate first in about 70 ft. of water. It is capable of drilling in depths to 100 ft.

Offshore Constructors is a joint venture of Bechtel Corp., DeLong Corp., Healy Tibbitts Construction Co., and Raymond Concrete Pile Co. The drilling operations have been sub-contracted to Sun Marine Drilling Co., a subsidiary of San Joaquin Drilling Co.

The measurements . . . The platform is 200 by 100 ft. and 13-ft. deep. It weighs 4,000 tons. The platforms' eight caissons are 6 ft. in diameter and 195 ft. in length. Unlike most gulf-type platforms, this one does not have living quarters, as it will be operating within 3 miles of shore.

In going to a drilling platform instead of floating drilling barges used by all other California offshore operators, Monterey stressed the factor of stability in making its choice.

By using the platform, Monterey won't have to pull off the hole in rough weather as the floating barges may have to do. Also, while the platform will be used initially for strat drilling, it is capable of development drilling below 15,000 ft.

Review of Gas Case Denied

WASHINGTON.—The Supreme Court has again refused to review the Federal Power Commission's order granting Panhandle Eastern Pipeline Co. a "fair field price" for gas it produces.

The court last week rejected the company's petition for reconsideration of its October 8 order, which affirmed the action of the District of Columbia Circuit Court sending the case back to the FPC *(The Oil and Gas Journal, November 5, page 78)*.

With the court contest settled, the FPC now must refigure the price Panhandle will get for its own production. The Circuit Court held the commission could use fair field price. But it ruled it would also have to compute the price on the traditional rate base, if nothing more than as a "point of departure."

Union Boosts Prices

● California postings rise an average of 20 cents; big gain is in heavy crude

LOS ANGELES.—Union Oil Co., effective November 19, increased its posted prices for California crude an average of 20 cents per barrel.

The increase was 40 cents for 14° gravity and heavier. It scaled down to 1 cent for 35° gravity, with no increase above that point.

Gasoline and bunker fuel prices didn't change, but posted mid-barrel product prices were increased 1 cent per gallon.

Union currently buys one-third of the crude requirements of its five California refineries, which have a daily capacity of about 200,000 bbl. Its current company-owned and controlled production is about 100,000 bbl. daily. Throughput has averaged about 150,000 bbl. daily this year. Union's move was met quickly by only Wilshire Oil Co.

Three reasons . . . The price increase is due to a dramatic change in the heavy-fuel picture which has developed over the past year.

Last winter West Coast oil companies shipped 10,000,000 bbl. of residuals to the East Coast on a "distress"

Union Oil's New Postings

Gravity	Signal Hill	Cat Canyon	Wilmington	Midway-Sunset
10-10.9		$1.87		$2.19
11-11.9		1.98		2.24
12-12.9		2.08		2.29
13-13.9		2.15		2.34
14-14.9		2.22	$2.53	2.38
15-15.9		2.24	2.56	2.43
16-16.9		2.26	2.59	2.47
17-17.9		2.28	2.63	2.52
18-18.9	$2.57	2.29	2.67	2.57
19-19.9	2.60	2.30	2.70	2.62
20-20.9	2.64	2.31	2.73	2.67
21-21.9	2.68	2.32	2.77	2.71
22-22.9	2.72	2.33	2.80	2.75
23-23.9	2.76	2.34	2.84	2.80
24-24.9	2.80	2.35	2.88	2.85
25-25.9	2.84	2.36	2.91	2.90
26-26.9	2.88		2.94	2.95
27-27.9	2.92		2.98	3.00
28-28.9	2.97		3.03	3.05
29-29.9	3.02		3.08	3.10
30-30.9	3.07		3.12	3.15
31-31.9	3.13		3.16	3.20
32-32.9	3.19			
33-33.9	3.25			
34-34.9	3.31			
35-35.9	3.36			
36-36.9	3.40			
37-37.9	3.43			

basis due to overproduction. Today heavy crudes have a strong demand and are in short supply. Three factors are largely responsible:

. . . A cut in electric power available to Southern California from Hoover dam. A year ago Los Angeles was told that, due to the low water level behind the dam, the city's allotment of Hoover dam power would be slashed 35 per cent.

This threw the burden on steam-generation plants, which use residual fuel for heat. Since then Los Angeles' payments for residuals have climbed from 50 cents a barrel under the posted price to 50 cents over the posted price.

. . . Increased imports of lighter crudes as California's production failed to keep pace with rising demand. Processing of the lighter crudes has resulted in a smaller yield of residual fuels.

. . . Rapid increase in coking facilities in California refineries. At present coking units with a combined capacity of 46,000 bbl. daily are nearing completion in the state. This will result in a still further drop in production of heavy fuels.

Wild Well Quieted

5-month blowout offshore is ended by relief well

ABBEVILLE, La.—Union Oil Co. of California reported last week that it had killed an offshore well which had been out of control more than 5 months.

After many costly delays the operator successfully pumped 800 bbl. of cement into a relief hole and stopped the flow from the wild gasser in the Vermilion area of the Gulf of Mexico. The wild well, A-1 O.C.S.-0297, drilled in 25 ft. of water, was killed November 17. It blew out at 11,435 ft. last June 7 and had been out of control since June 8. Gas from the well was ignited a few days after the blowout and had been burning ever since.

Company officials declined to release any estimates of the volume of gas wasted during the blowout or of the total financial loss involved.

The worst blowout in the history of the offshore oil industry, it resulted in a loss of about $2,000,000 in equipment alone. The blowout caused one platform and drilling rig to capsize, and another unit to be erected for the directional well through which it was brought under control.

Reports indicated it might be possible to complete the relief well as a producer in a higher formation, but a company spokesman said no decision had been reached.

Processing Briefs

California Oil Co., Standard Oil Co. of California's East Coast subsidiary, has purchased Lincoln Oil Co. of Boston, a large independent New England marketer. Lincoln maintains about 160 service stations in the Boston area and has a large heating-oil business. It has sold California products for about 10 years. Purchase price was not disclosed.

A 3-million-volt Van de Graaff accelerator has been constructed at the Shell Development Co. laboratory at Emeryville, Calif. The new unit accelerates electrons to a speed of 184,400 miles per second—so near the speed of light that their effective mass is multiplied sevenfold.

Dr. Harold Gershinowitz, Shell Development president, said a specially trained group of scientists will use the electron beam in learning more about what goes on between molecules—and inside molecules—during certain processes.

The famous "Magic Barrel" lecture demonstration has a "running mate." It's the "Billion Dollar Briefcase." By the same author, H. C. Thompson, the new demonstration is designed to show big and little businesses how they depend on each other to perform industry functions. Thompson is assistant promotion manager of the Du Pont's petroleum chemicals division. He said the lectures supplement each other.

Carbide & Carbon Chemicals Co. will break ground this fall on a multimillion dollar engineering building at its South Charleston, W. Va., research center. The futuristic building, in the shape of a giant X, will provide space for more than 500 engineers.

It is the second major project for the center announced this year. A development laboratory will be started at the same time. Both buildings are scheduled for completion in the first quarter of 1958. Carbide & Carbon is a division of Union Carbide & Carbon Corp.

Ethyl Corp. will build its proposed West Coast tetraethyl-lead plant adjacent to the Dow Chemical plant at Pittsburg, Calif., on property acquired by Dow. Construction will start some time next spring.

Humble Oil & Refining Co. plans a benzene plant near its huge Baytown, Tex., refinery. Capacity will be 24 million gallons annually. Work will start this year with completion scheduled late in 1957. Output will be moved by barge, tank car, and truck mainly in the Gulf Coast area where demand is high for the basic petrochemical building block.

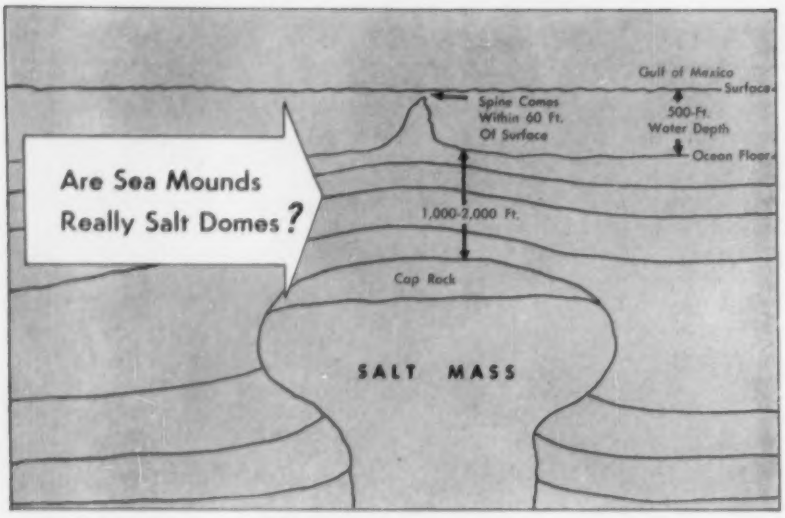
Sunray Mid-Continent Oil Co. has put into operation a new cycling plant in the Northwest Branch field of Acadia Parish, Louisiana. The plant, built by Tuloma Builders, Inc., has a capacity of 27,000 M.c.f. of natural gas daily. It will serve the field discovered in 1951 by the former Sunray Oil Corp.

El Paso Natural Gas Co. has dropped its plans for a plant to process 20 million cubic feet of gas daily from South Andrews field, Andrews County, Texas. El Paso still plans to distribute the gas to its customers, but Shell Oil Co. has agreed to process it.

Also for Refiners . . .

New 1957 model autos sport higher compression ratios and greater horsepower. But for refiners they mean a higher quality fuel will be needed (P. 44) . . . Corrosion engineers now have a new electrical tool to measure loss of metal from probe in system under study (P. 47) . . . Esso Standard's third grade is paying off. After 6 months, company reports appreciable gain in premium sales and only minor effect on regular (P. 48) . . . Day may be near when making polyethylene by irradiating ethylene on commercial scale will be routine (P. 54) . . . Indiana Standard's new oxidation process will get first commercial application in new Amoco petrochemical plant near Whiting refinery (P. 55) . . . Union Oil is boosting prices about 20 cents per barrel on heavier California crude (P. 56) . . . Low-gravity crude prices also have been boosted in Venezuela by Shell and Creole (P. 67) . . . East Coast and Western European refiners are sharing the extra 10,000,000 bbl. jump in oil shipments from the Gulf Coast this month (P. 66).

PLUS THESE TECHNICAL FEATURES: New waste-water plant solves a problem for Richfield in California (P. 80) . . . Pointers for gas-engine overhaul (P. 86) . . . Effect of sensitivity on road octanes (P. 93) . . . How to check octane numbers above 100 (P. 96) . . . Tips for reducing costs, time, and hazards (P. 97) . . . The Foreman's Page (P. 99) . . . and Questions on Technology (P. 100).



Sea mounds may lead to . . .

Deep-Water Oil Reserves

JUTTING up from the ocean floor in the Gulf of Mexico are hills and peaks which have intrigued oil men for a long time.

Some of these "sea mounds" are several miles in diameter. Others are small pinnacles and spines that rise up abruptly from the relatively flat bottom of the gulf.

Most of the mounds are strung out along the 600-ft. contour of the ocean floor, with the greatest concentration along the outer margin of the Continental Shelf.

What underlies the sea mounds? Oil men want to know:

. . . **If the sea mounds** are really salt domes, marking the underwater trail to profitable oil reserves.

. . . **If the mounds' tops** can be used as drilling "platforms" in the 600-ft. depth of water where they are located.

. . . **If it will be economical,** in the near future, to anchor mobile drilling barges in these deep and rough offshore waters of the gulf.

A study by Dr. L. L. Nettleton, of Gravity Meter Exploration Co., Houston, gives some clues to these questions, including convincing evidence that the mounds are salt domes.

Nettleton's conclusions, presented at a recent meeting of the Society of Exploration Geophysicists in New Orleans, are based on a detailed gravity survey of the sea mound called "Way." This mound is located 125 miles southeast of Galveston on the outer edge of the Continental Shelf.

Coral . . . Way is one of the larger sea mounds. With a diameter of several miles, it rises up in water 400 to 500 ft. deep. The top of the mound comes close—within 60 ft.—to the surface of the water.

The central spine of this pronounced "hill" on the ocean floor is apparently covered with coral, which may account, in part, for its growth.

Way was chosen for the survey because of its size and because it is markedly similar to many of the other large hills in the Gulf of Mexico.

Surveying Way was no easy job. Bad weather caused a delay, but finally the crew was able to lower the meter to the ocean floor. Luckily the crew waited until last to take the spinal readings because the instrument was badly damaged when it apparently became wedged in the jagged coral surface of the spine.

The firm ran two gravity surveys across the mound, requiring 50 readings. The gravity work mapped a large circular minimum that is very similar to Gulf Coast salt domes.

Magnetic surveys eliminated the possibility that the mounds are igneous in origin, even though the circular shape of the mounds might indicate such origin.

Dr. Nettleton concludes that the salt probably comes to within 1,000 to 2,000 ft. of the ocean floor at Way. Diameter of the salt plug itself is about 4 or 5 miles, and it probably has a large overhang.

Some confirmation . . . Substantially the same general salt-dome conclusions were reached when the Student Section of the Society of Exploration Geophysicists at the University of Houston undertook a similar survey.

This survey involved a smaller sea mound, also along the margin of the Continental Shelf, southeast of Houston. This mound has a relief of 120 ft., and is 1,800 ft. long and 800 ft. wide.

Although it is much smaller than Way, geophysicists consider that the large and small mounds are similar in origin. Here again, the gravity data showed a decided minimum, typical of a large, shallow piercement salt dome.

In another paper presented at the recent S.E.G. meeting, Authors W. E. Allen of Superior Oil Co., L. Stanley of Sinclair Oil & Gas Co., and T. F. Vining of Shell Development Co., all of Houston, conclude that this smaller mound survey reflects a salt dome intrusion, with a probable overhang.

Ready-made platforms? . . . Are the spines of these mounds ready-made platforms for drilling operations?

Nettleton is cautious here, too, because the surface of the top of the mounds is generally so rugged. Furthermore, the spine lies directly over the salt mass; thus, a well on the spine would only evaluate the oil possibilities of the cap rock.

On most salt domes, this cap rock production is of minor importance when compared with the prolific oil traps on the flanks of the dome, such as Barbers Hill and Spindletop in Texas.

Nettleton posed another question: What types of sediments are present below the ocean floor underlying these mounds?

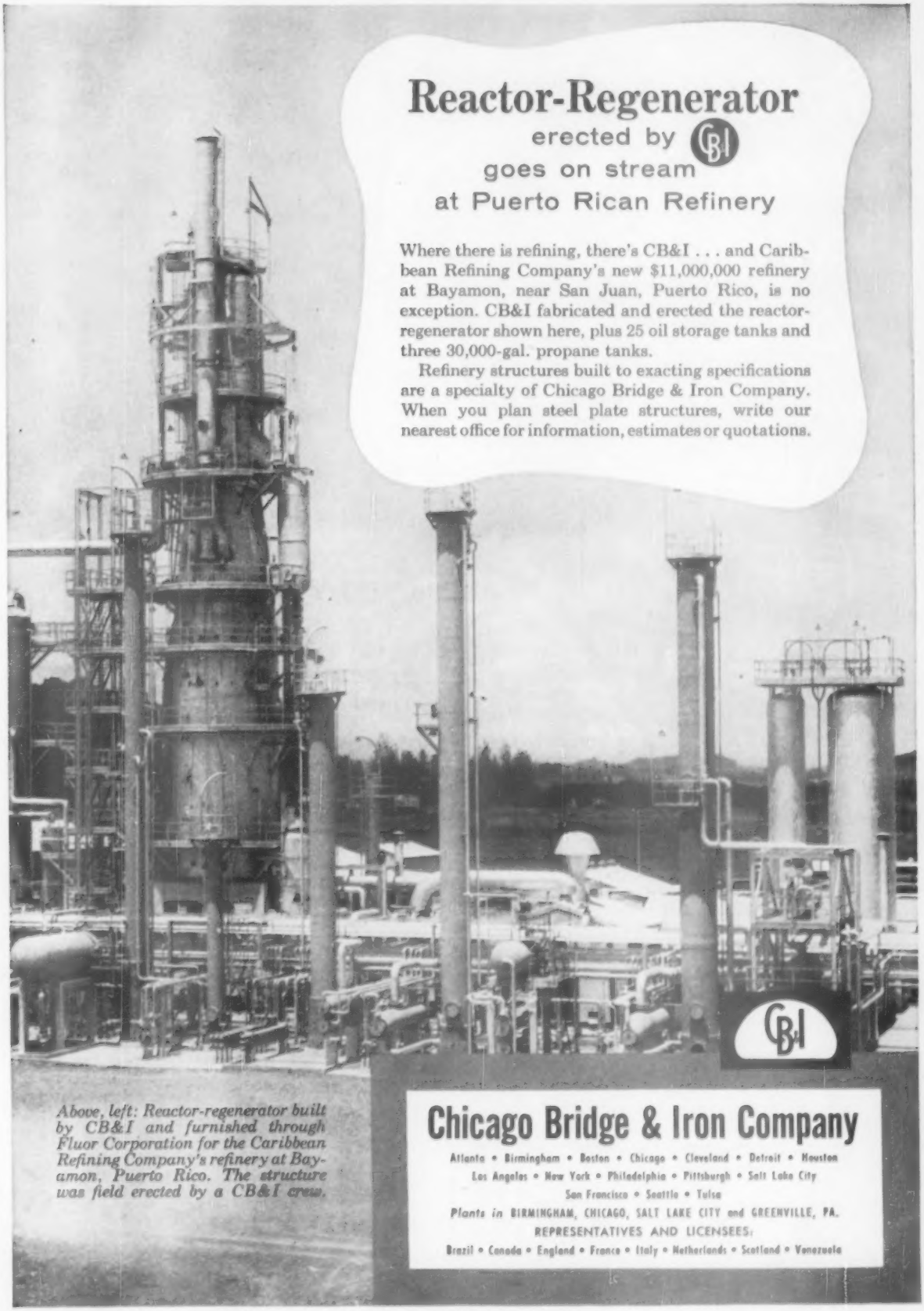
Once again, no one really knows. Some of them are certainly close enough to shore to have Tertiary sands under them.

Deep-water rigs . . . Big mobile drilling rigs may give the answer in the next year or two.

So far, oil firms have operated successfully in water 112 ft. deep *(The Oil and Gas Journal, November 12, page 140)*. To drill in five or six times as much water will require new techniques.

Engineers with Shell Oil Co. predict that new methods and equipment will make deep-water drilling a reality in the gulf within the next few years *(The Oil and Gas Journal, October 1, page 56)*.

When the floating platforms are improved to withstand the comparatively rough waters of the gulf, a huge new area for exploration will be opened up. And then the secret of the sea mounds will be exposed.



Reactor-Regenerator

erected by CB&I goes on stream at Puerto Rican Refinery

Where there is refining, there's CB&I . . . and Caribbean Refining Company's new $11,000,000 refinery at Bayamon, near San Juan, Puerto Rico, is no exception. CB&I fabricated and erected the reactor-regenerator shown here, plus 25 oil storage tanks and three 30,000-gal. propane tanks.

Refinery structures built to exacting specifications are a specialty of Chicago Bridge & Iron Company. When you plan steel plate structures, write our nearest office for information, estimates or quotations.

Above, left: Reactor-regenerator built by CB&I and furnished through Fluor Corporation for the Caribbean Refining Company's refinery at Bayamon, Puerto Rico. The structure was field erected by a CB&I crew.

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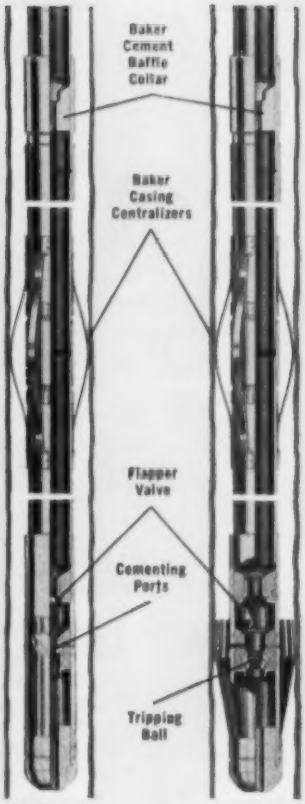
Protect permeable low pressure zones with the BAKER TRIPLEX cementing shoe...

The overlapping Petals form a strong, tight bridge to prevent downward movement of slurry.

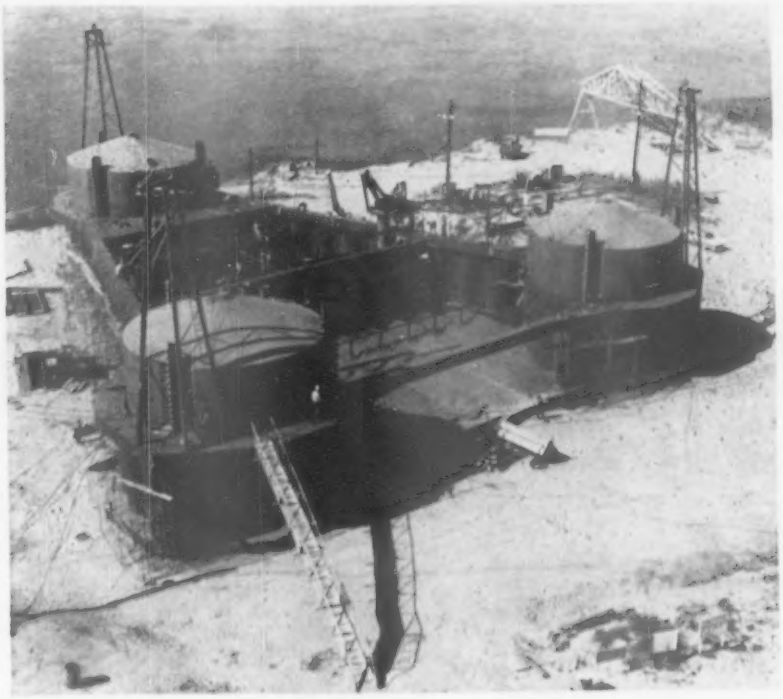
Cementing casing at a predetermined point above bottom, and at the same time protecting a lower, permeable zone from cement contamination always has been a difficult problem. Such work is now a routine operation with a Baker TRIPLEX Cementing Shoe.

A special float shoe is combined with a Baker Metal Petal Basket that expands to form a bridge and retain cement slurry **above** the Basket, even in large-diameter or irregularly shaped holes. The TRIPLEX Shoe, with its flapper-type back-pressure valve, operates as a conventional **float** shoe while landing the casing and conditioning the hole. When cementing is done and pump pressure is stopped, the valve closes and cement is **held in place behind the casing until it sets.**



Baker Casing Centralizers are installed on (and above) the shoe joint, thus providing a uniform annulus to receive the slurry. While running-in, a Hold-Down Strap (secured by shear screws) retains the Basket against the TRIPLEX Shoe, and the cementing ports are covered by the Tripping Valve. After reaching the desired point, a Tripping Ball is dropped to seat upon the Tripping Valve. Pressure is applied to shear the screws, force the Tripping Valve downward, and expose the cementing ports. This action releases the Hold-Down Strap and the Basket expands against the walls of the hole. When cementing starts, the slurry is directed upward by Baker "Whirling" Action, and retained **above** the shoe by the Metal Petal Basket.

BAKER OIL TOOLS, INC., HOUSTON • LOS ANGELES • NEW YORK



Zapata readies new tripod rig. It's . . .

Scorpion's Big Brother

VICKSBURG, Miss. — The second three-legged "monster" for offshore drilling is taking shape on the bank of the Mississippi River here.

The $3,250,000 portable drilling platform is being built by R. G. LeTourneau, Inc., for Zapata Off-Shore Co. It is similar in design to the "Scorpion," a slightly smaller unit which went to work for Zapata last spring.

The three "feet" shown above will rest on the gulf bottom and support legs 145 ft. high. Vertical gear racks, located at all three corners of each triangular leg, mesh with giant cogwheels to raise and lower the legs.

Each of the lower tanks or "feet" is 35 ft. across and 32 ft. deep. They serve as ballast in raising and lowering the unit.

Nine LeTourneau Electric Gearmoters will force each of the legs up or down. The earlier unit has 21 motors for each spud.

The "statistics" . . . Deck of the new platform will be 194 ft. long and 152 ft. wide. In addition to drilling equipment it will contain housing facilities for a 45-man crew.

The platform, designed to operate in about 85-ft. water, will weigh 8,000,000 lb. when fully equipped. It is being constructed of steel from LeTourneau's mill at Longview, Tex.

When completed, the unit will be floated 400 miles down the Mississippi River to the Gulf of Mexico. Delivery is scheduled about February 1.

BIG "COGS" in the operation are these vertical gear racks. The cogwheels mesh with teeth of steel plate and "walk" it up and down to raise and lower legs of barge.

New FPC Policy

Gas imports from Canada possible under new ruling

WASHINGTON. — The Federal Power Commission has reversed its natural gas import policy. The action could eventually open the door to more Canadian gas imports into the U.S.

The policy reversal occurred last week when the FPC refused to throw out the applications of Midwestern Gas Transmission Co. and Tennessee Gas Transmission Co. for permission to import 204,000,000 cu. ft. daily of Canadian gas and export 48,000,000 cu. ft. daily of United States gas *(The Oil and Gas Journal, October 8, page 124)*.

The commission affirmed a decision by Examiner Francis L. Hall denying motions for dismissal of applications, filed by other pipeline companies and by coal and railroad groups.

The issues raised in the case are "too important in the public interest, and the effects on the public of our answers to them are too critical" to dispose of them without full study, the FPC said.

Dependency . . . The FPC said, however, that unless "all matters of judgment and discretion are resolved in favor of the applicant, it is questionable whether the certificate should be issued."

The opposing interests challenged the Midwestern-T.G.T. program on the grounds it was an invasion of other pipelines' markets and would make a large area dependent upon Canadian gas. They pointed out the latter would be contrary to past FPC policy.

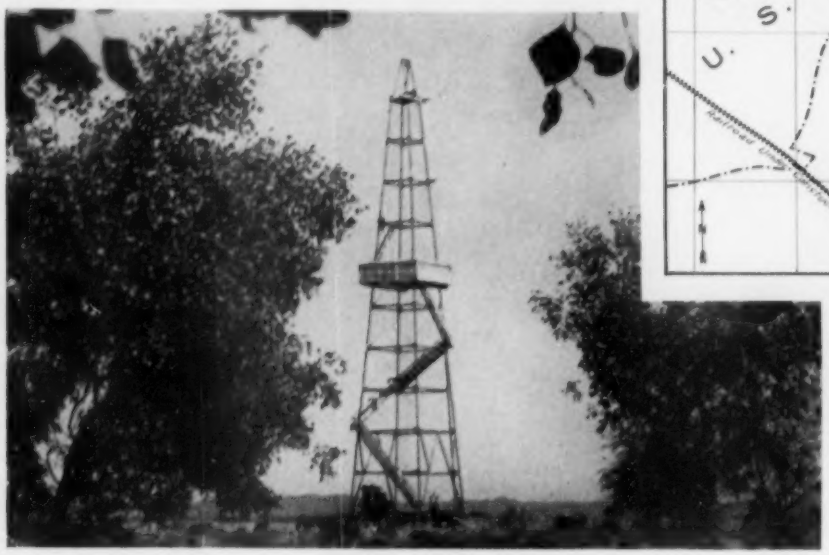
The FPC, however, suggested that a new policy might be desirable. It said it might "envisage circumstances under which a project relying wholly upon Canadian gas could be found to be in the public interest, depending on the particular facts of a given case."

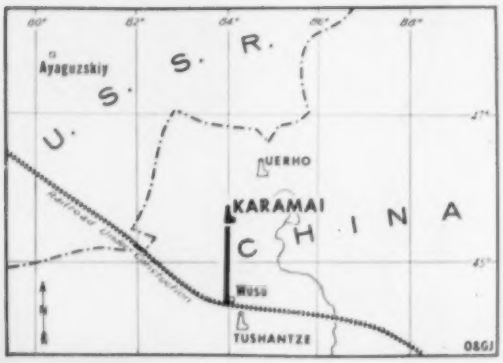
Forced Gas Sales Illegal

OKLAHOMA CITY.—Phillips Petroleum Co. has won its legal battle against a 1955 Oklahoma law forcing it to sell gas to Panhandle farmers to operate their irrigation pumps.

The Oklahoma Supreme Court last week declared the law unconstitutional. The court held the measure constituted taking property without due process of law.

The law made it mandatory for a natural-gas producer to sell gas for irrigation pumps to the owners of land where the producing wells are located. Phillips took the issue to court when landowners petitioned the state Corporation Commission to set prices on the gas Phillips was being forced to sell.





Sinkiang oil boom touted as rivaling any in world as . . .

Red China Puts Big Bet on Karamai

NEW OIL FOR CHINA is being funneled into barrels for shipment from Karamai oil field to other areas. The Karamai field of northwestern Sinkiang province is estimated to have reserves of 100 million tons of oil. Chinese report present drilling has reached boom proportions (Photographs by Eastfoto).

RED China is betting $290 million this year that it can eventually make its infant oil industry produce enough crude to meet the country's internal needs.

The Communists' best bet so far is apparently Karamai field in Sinkiang Province of Northwest China. The government first revealed the existence of the new field 4 months ago *(The Oil and Gas Journal, August 13, page 103)*.

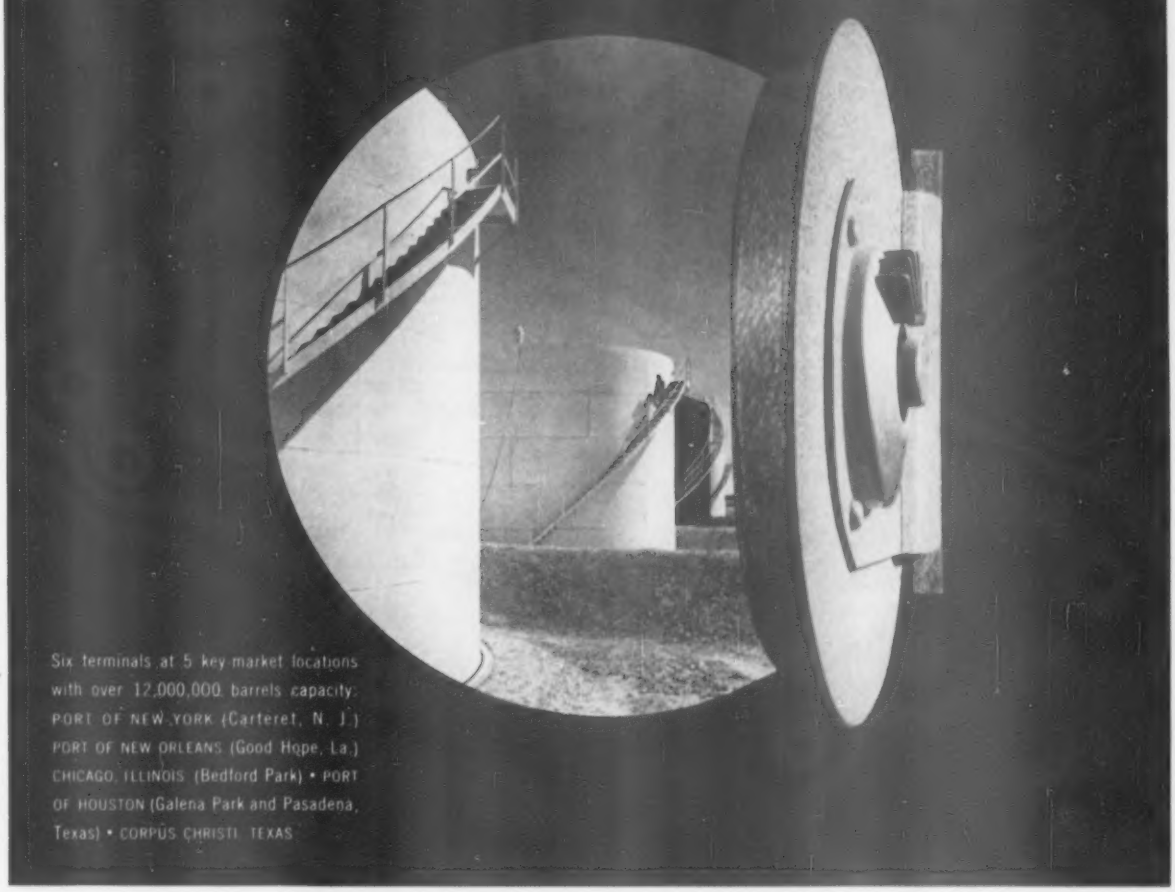
The Chinese now say this field is producing more than 2,000 bbl. daily after an intensive drilling program was started in the area in the spring of 1956. China Reconstructs, an English-language magazine published in Peking, revealed recently that the field now has 20 wells, each producing from 70 to 140 bbl. daily.

Red China's oil production this year will average 23,000 bbl. daily according to Yang Hai-pung, director of the Chinese Ministry of Petroleum. He says this covers only about one-third of the country's oil consumption, but the Chinese expect to be producing from 100,000 to 120,000 bbl. daily by 1962, the end of the current 5-year program. Hai-pung says this projected output will meet from 50 to 60 per cent of the country's needs at that time.

Karamai field . . . The newly discovered field has sparked an oil boom in Northwest China that rivals any in the

how to keep a

MULTI-MILLION-DOLLAR SECRET



Six terminals at 5 key market locations with over 12,000,000 barrels capacity: PORT OF NEW YORK (Carteret, N. J.) PORT OF NEW ORLEANS (Good Hope, La.) CHICAGO, ILLINOIS (Bedford Park) • PORT OF HOUSTON (Galena Park and Pasadena, Texas) • CORPUS CHRISTI, TEXAS

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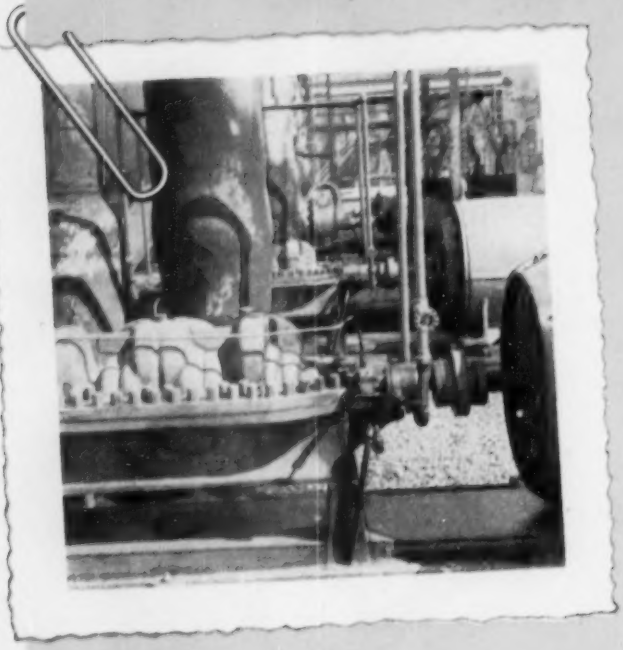
BJ FIELD ENGINEERS' REPORT

Subject: Texas Gas Corp. installation

BJ MECHANICAL SEALS BOOST OLD PUMPS' OUTPUT 124 GPM . . . ELIMINATE NEED FOR NEW PUMP INVESTMENT!



Expansion of the Texas Gas Corporation's Winnie, Texas refinery created a need for 120 gpm more output than the existing high pressure charge pumps were delivering. Two solutions were considered: (1). add another pump of the same size as the pumps already in operation; or (2). purchase a large single-capacity pump to replace existing pumps.

Working with Texas Gas engineers, Byron Jackson suggested a third solution: install BJ Mechanical Seals on the existing pumps. This eliminated the use of packing and throttle bushings and stopped the extreme leakage loss occuring at these points.

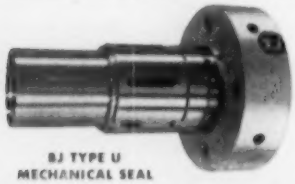
BJ Type U Mechanical Seals were installed on one of the pumps. Tests showed the flow rate was increased 62 gpm. The company immediately installed seals on their second charge pump. The new combined output of the mechanical-seal-equipped pumps was increased 124 gpm - more than sufficient to meet the expanded requirements.

In addition to this tremendous increase in pumping efficiency, other big benefits were realized: elimination of repacking expense and downtime losses; helpful savings in cooling water and piping; and a safer, cleaner working area around the pumps where formerly a "swamp" of leakage occurred.

Whatever your pumping requirements, it will pay you to investigate now the money-saving advantages of BJ Mechanical Seals. Call your local Byron Jackson office or write . . .

90% Saving on Piping!

After BJ Mechanical Seals were installed, approximately 90% of the piping was removed from the pumps. This maze of piping with packing had previously been necessary for cooling the stuffingboxes and for recirculating the high pressure leakage from the throttle bushings. Now there are only two lines used for handling cooling water to the bearing boxes and a 1¼" line running from seal cover to seal cover.



BJ TYPE U
MECHANICAL SEAL

BYRON JACKSON PUMPS
INCORPORATED

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world, according to the Chinese publication.

The field lies between the Tien Shan and Altai mountain ranges at the extreme northwest tip of Chian at the western end of the Dzungarian basin. It is about 100 miles north and slightly west of the old Tushantze field where the Russians once operated a small topping plant.

The Chinese say the productive horizon is a relatively shallow stratigraphic trap in the lower Jurassic. But no producing depths have been revealed. The crude is described as of "first-rate industrial value" and the Chinese say "high-grade lubricants can be refined from it." No gravity figures have been revealed.

In order to develop the region the government is involved in an all-out program to populate the sandy desert area with workers and equipment for a major oil field. The single road to Karamai from the Wusa area is filled with a stream of trucks loaded with drilling and producing equipment shipped in from plants all over China. On their trip back, the trucks are hauling Karamai crude.

Second structure tested . . . The Chinese have located what they call a second promising structure at Uerho, 80 miles northeast of Karamai, and the first test is now being drilled here.

The Chinese publication says geologists suggest that it may be connected with Karamai, forming a productive region of 1,500 sq. miles underlying all the Dzungarian basin.

Mixed Blessings

Receding Soviet sea good for oil, tough on shippers

THE Caspian Sea's declining water level is proving to be both a curse and a blessing for Russia's oil industry.

On the one hand, Soviet tankers from Baku are experiencing greater difficulty in navigating the shallow northern Caspian near the Volga River port of Astrakhan, the shipping point for Baku oil moving to northern cities.

At the same time, extension of the Emba fields on the Caspian's northeast shore is indicated as the sea retreats.

The Russian press reports an oil discovery about 15 miles southwest of Karaton, an established producing area on the southern edge of the Emba basin salt-dome field. Location of this new Tazhigali deposit was, until recently, under water.

Tazhigali's first producer was completed at a depth of 3,716 ft. Three more wells are being drilled.

Sun Expands Abroad

Subsidiaries for Venezuela, Colombia, and Pakistan set up as company prepares to make more moves in foreign fields

SUN OIL CO., which has been moving quietly for months to expand its operations outside the United States, last week formed three new foreign subsidiaries and created a foreign operations department in the parent company.

Ted C. Stauffer, Philadelphia, former manager of Sun's central production division at Evansville, Ind., and more recently administrative assistant to John G. Pew, Sun's vice president in charge of production, will head the new department.

Stauffer will also be president of three new subsidiary companies—Venezuelan Sun Oil Co., Colombian Sun Oil Co., and Pakistan Sun Oil Co.

In making the announcement last week, Pew revealed that Sun is negotiating for exploration acreage in Pakistan and in Colombia. The company recently received exploration acreage in Venezuela along with other companies. It has held a Cuban concession for several years and recently acquired a concession in the Bahamas.

Sun Production Co. of Bahamas and Sun Production Co. (Deela), operating in Guatemala, are two other foreign operating subsidiaries. The company operates in Cuba and Canada under the name of the parent company.

The new department . . . B. E. Warren, Dallas, will head the Latin American division of the newly created foreign operations department in Philadelphia. He also will be vice president and general manager of the Venezuelan and Colombian subsidiaries.

Warren, who formerly headed the natural-gas department of the company's southwestern production division at Dallas, was in Venezuela with Sun from 1920 to 1925.

Assisting Stauffer in management of the new department will be Winfield Givens, foreign representative of the department and manager of Sun's land department in Philadelphia; Herbert J. Weeks, geological counselor for foreign operations; and J. W. Timmins, Dallas, formerly attorney of the southwestern production division.

Latin American departments . . . The Latin American division is organized into three main departments: Geology and geophysics, headed by Paul W. McFarland, Dallas; operations, headed by Kenneth E. Montague, Maracaibo; and accounting and purchasing, headed by Davis B. Crow, also Maracaibo.

McFarland has been assistant chief geologist for the southwestern production division. He was a Sun geologist in Venezuela in the early 1920's. Montague was supervisor of the reservoir section study of the company's Gulf production division at Beaumont. Crow was supervisor of the gas accounting department at Dallas (For additional appointments, see page 156).

Wild Well Dies

Iran's famous Qum wildcat bridges, halts big oil flow

IRAN'S wild well, Alborz 5, solved a troublesome problem for National Iranian Oil Co. It bridged and shut itself in.

Engineers for N.I.O.C., the drilling contractor, and Eastman International Co., who planned to drill a relief well, were watching the wildcat discovery warily last week. They're afraid it may blow out again.

The well blew in late in August when the bit broke out of shale and entered a porous limestone formation below 7,800 ft. It blew wild for weeks at an estimated flow of from 80,000 to 150,000 bbl. daily before it was partially capped and the flow diverted to a 4-in. flow line.

By the time it shut itself in early last week, the flow had dropped to about 15,000 bbl. daily and was being diverted into open pits by a 1½-in. flow line.

The pressure and flow of the well have been gradually decreasing for several weeks. Engineers believe this has been the result of the bridging which shut it in, rather than a sharp decline in reservoir pressure.

The Qum anticline on which the well was drilled lies in a Miocene salt basin. The subsurface formations of the basin are marked by numerous salt strata, and it is believed that a flowing salt strata is what bridged the well last week.

Drilling & Exploration Co. has drilled four previous wells in the Qum area for the Iranian government company. Two of them had promising oil shows, but both wells were lost by crushed casing down the hole, apparently from flowing salt.

Gulf Oil Flow Jumps

U. S. firms moving 10 million barrels extra this month; most will help relieve Europe from Middle Eastern pinch

HUGE quantities of emergency oil are moving out of the Gulf Coast to replace the flow of crude shut off in the Middle East.

Companies report privately that more than 10,000,000 bbl. above normal will be shipped from gulf ports during November. This averages 337,000 bbl. daily but actually represents a much higher daily movement. The big rush of extra oil didn't get started until mid-month.

Shipments scheduled for the rest of the month or already on their way break down like this:

... 7,220,000 bbl. extra to western Europe.

... 1,990,000 bbl. diverted to East Coast refineries to replace Middle East crude lost there.

... 900,000 bbl. to a gulf refiner who normally runs Middle East oil.

This includes both oil shipments by companies to subsidiaries and sales to outside purchasers. Companies involved in the shipments include Atlantic Refining, Crown Central, Gulf, Humble, Magnolia, Shell, Sinclair, Standard of California, and Texaco (see table).

Bleak winter . . . Even though this big oil movement was getting under way, western Europe was looking ahead to a bleak, oil-short, and cold winter.

Nations there reasoned that the emergency crude from the U. S. would not arrive in sufficient volume or in time to prevent a pinch.

While diplomats and soldiers attempted to substitute United Nations forces for British and French troops in the Suez Canal area, these other developments occurred on the oil fronts:

... Western European nations moved to coordinate oil-buying and transporting efforts through the Organization for European Economic Cooperation.

... Rationing of oil products was ordered in most western European countries to conserve present supplies and reduce amounts of replacement crude needed.

... U. S. officials kept their plans for helping under wraps but gave indications help would come when the Suez military situation was stabilized.

Political problems . . . Two big questions—both with a political tinge—still remain to be answered:

... Will the U. S. Government give its official blessing to coordinated efforts by private oil industry to supply Europe with the stop-gap oil?

... How soon can the Suez Canal be reopened, and who will do the job?

There were still no indications last week that Washington will back away from its position that any official oil help for Britain and France must await withdrawal of Anglo-French troops from Egypt.

French government and industry sources are making no secret of their chagrin at this. They imply pretty strongly that the U. S. is backing out on the elaborate plans made last August to supply Europe with oil if Suez were closed. The French do not make the same distinction Washington does on just how the canal happened to close down.

Also it became apparent last week that both France and Britain are trying to move through the 17-nation O.E.E.C. rather than individually. The O.E.E.C. council decided on a "pooling" system to supply all member nations with oil instead of "each country scrambling for its own interests."

Such an arrangement might possibly take the U. S. off a diplomatic hook. If the U. S. stepped in officially to help supply the O.E.E.C. pool with oil, it might be able better to justify such action before the Arab world.

Action coming . . . The U. S. Government, however, is ready to move when the right time comes.

But that time will depend on the success of the United Nations in getting its police force into Egypt and getting the British and French military out.

Above-Normal Gulf Shipments

Following figures, in thousands of barrels, represent above-normal crude moved from Gulf Coast ports already this month or scheduled for shipment before December 1:

	Exports	East Coast
Atlantic		330
Crown Central	250	
Gulf	540	360
Humble	4,140	
Magnolia		450
Shell	840	
Sinclair	450	150
Standard of California		360
Texaco	1,000	340
Total	7,220	*1,990

*An extra 900,000 bbl. will be diverted to Eastern States Refinery, Houston, to replace Middle East crude it normally charges to stills.

The plan to be followed then may be along lines worked out last summer by the Middle East Emergency Committee, a group of representatives of 13 U. S. oil firms with international operations. Whether the plan will be administered by the MEEC or the O.E.E.C. is yet to be determined. Coordination of buying and pooling of tankers is the key to the plans of both.

But actual working of the plan will be scrutinized closely by Atty. Gen. Herbert Brownell. He told Congress last week that he approved the original program reluctantly. Brownell explained he went along with the idea because he realized that Europe could not be left without oil.

Rearrangement of the European supply pattern will have an extremely serious impact on the economy and stability of Europe, Brownell said. It will cost more than $1 million a day to substitute dollar oil for Middle East crude. Changes in tanker routes will increase freight costs by not less than $800,000 a day "even if tanker rates remain at their existing levels."

Canal opening . . . The problem of clearing the canal itself is becoming a question of "who" and "how long."

Egypt's Nasser has made it clear he doesn't intend for the British and French to clear the canal. He regards it solely as Egyptian property. Nasser has asked the United Nations to help do the job.

The British and French are proceeding with plans to clear the small portion of the canal zone now in their hands. If and when they withdraw troops, Egypt is certain to object to continued clearing operations.

U. N. Secretary General Dag Hammarskjold has made arrangements with E. M. V. Svitzer, a Danish salvage firm, and L. Smit & Co., Rotterdam, to help clear the canal. Current reports in Europe are that two West German salvage vessels have been chartered by the U. N. to help with the job.

Effect on producers . . . Meanwhile, the Suez shutdown is beginning to prove troublesome also to Middle East producing countries.

Iraq's 750,000 bbl. daily production was shut in except for about 30,000 bbl. daily going to the government refinery at Daura near Baghdad and Minov liftings at the shallow-draft port of Fao at the head of the Persian Gulf.

Saudi Arabia's normal production of more than 1,000,000 bbl. daily was being cut about 30 per cent, or about 300,000 bbl. daily to compensate for lack of tankers to lift crude at Ras Tanura and for the embargo of shipments to the British protectorate of Bahrain.

Trans Arabian Pipeline Co.'s system to Sidon on the eastern Mediterranean was operating at full capacity of more than 320,000 daily. Tapline is the only long Middle Eastern pipeline in operation.

Bahrain's 205,000 bbl. daily refinery was operating at only about 130,000 bbl. daily—30,000 bbl. of Bahrain production and another 100,000 bbl. from Iran.

There were no verified reports of cuts in production in Kuwait and Iran. But they are certain to come. London speculated that Kuwait would have to cut back by at least 20 per cent or about 225,000 bbl. daily.

Picture in Europe . . . Meanwhile, the supply picture in Western Europe looked like this:

. . . Austria is the only country with hope of staying aloof from the oil crisis. West Europe's largest oil producer, Austria is able to supply herself with oil with the possible exception of fuel oil.

. . . Belgium has not yet begun any formal rationing. The government has requested its people informally to conserve fuel and reduce auto travel.

. . . Denmark has ordered a 20 per cent cut in fuel-oil consumption and a 25 per cent reduction in gasoline use. Distributing companies will apply the cuts.

. . . France banned weekend pleasure driving, but got some reverse effects. Reports from Paris last week indicated gasoline consumption jumped about 50 per cent in the country as hoarders swarmed to gasoline supplies. Paul Ramadier, French minister of finance, predicts mid-January as the critical point for France.

. . . Italy has no formal rationing as yet, but such action appears inevitable. Stocks of oil and gasoline are estimated at little more than a month's supply.

. . . Norway has started what it calls "mild rationing" designed to cut consumption by 10 per cent.

. . . Sweden introduced oil rationing, banned weekend auto travel, and directed oil suppliers to cut deliveries to both industry and homes 30 to 50 per cent through January 20.

. . . Switzerland banned private auto travel on weekends and predicted full-scale rationing in the near future.

. . . United Kingdom ordered deliveries to distributors cut 10 per cent and will start full-scale rationing December 17.

The British Government asked all industry which converted from coal to oil to make the reverse conversion if at all possible.

Venezuela outlook . . . Western Europe got a warning last week that Venezuela could not be counted on for a tremendous spurt in oil production.

H. W. Haight, president of Creole Petroleum Corp., said only a small amount of additional oil could be obtained from Venezuela. He said fields there are already being produced at maximum efficient rates and added it would be difficult to increase output more than already planned.

Haight said Venezuelan production for the week ending October 29 averaged 2,543,446 bbl. daily, highest in history. The program there calls for a gradual, normal increase during 1957 to an expected high of 2,800,000 bbl. daily by the end of next year. A limiting factor to any further increase is pipe supplies and other materials.

Crude Prices Rise

Shell, Creole make higher postings for heavy crudes

TWO of Venezuela's leading oil producers last week increased posted prices on a dozen low-gravity crudes from 5 to 21 cents a barrel as the Middle East oil crisis firmed demand for the fuel-oil producing crudes.

Cie. Shell de Venezuela made the first move November 16 when it announced increases of from 5 to 15 cents on six crudes.

Creole Petroleum Corp. followed suit 4 days later with price boosts of 6 to 21 cents on six Venezuelan crudes of comparable gravity.

The Shell company increased three crudes by 5 cents a barrel. The crudes, f.o.b. points, and new prices are:

Cabimas, 22.0 to 22.4-gravity, f.o.b. Cardon, $2.20; the same Cabimas crude f.o.b. Cabimas jetty, a shallow draft lifting point, $2.12; Cabimas, 20.0 to 20.4-gravity, f.o.b. Las Piedras, $2.10.

Shell boosted three heavier crudes by 15 cents a barrel. The crudes, f.o.b. points and new prices are:

Tarapito, 16.5 to 16.9-gravity, f.o.b. Las Piedras, $1.95; Bachaquero, 14.5 to 14.9-gravity, f.o.b. Las Piedras, $1.91; Bolivar district heavy, 12.5 to 12.9-gravity, f.o.b. Cardon, $1.85; the same crude at either Cabimas buoy or Bachaquero (both deep-water loading points), $1.82; the same crude at Lagunillas, a shallow-water loading point, $1.77.

The Creole crudes, f.o.b. points, price increase, and new prices are:

Pedernales, 21.0 to 21.4-gravity, f.o.b. Capure (Pedernales), up 21 cents to $2.05; Mototan, 21.0 to 21.4-gravity, f.o.b. San Lorenzo, up 6 cents to $1.96; Temblador, 20.5 to 20.9-gravity, f.o.b. Boca de Uracoa, up 16 cents to $2.21; Quiriquire, 16.5 to 16.9-gravity, f.o.b. Caripito, up 14 cents to $2.35; Lagunillas heavy (flat), f.o.b. Amuay or Las Piedras, up 15 cents to $2.20; and Bachaquero, 16.5 to 16.9-gravity, f.o.b. Amuay or Las Piedras, up 15 cents to $2.05.

Both Lagunillas heavy and Bachaquero are also available at La Salina at 3 cents a barrel less than the Amuay and Las Piedras posting.

Guatemala Awards

Government issues 29 new concessions to eight firms

THE Guatemalan Government last week had made 29 awards of more than 8,500,000 acres in exploration concessions to oil companies which applied for acreage under the country's new petroleum law.

The latest grants by company and acreage are:

. . . Standard Oil Co. of Ohio, 34,157 acres in the province of El Peten.

. . . Petroleos Guatemaltecos, a Guatemalan company, 12,533 acres in Izabel province and 316,974 acres in El Peten.

. . . Tidewater Oil Co., 310,973 acres in El Peten.

. . . Union Oil Co. of California, two concessions in Alta Verapaz and El Peten. One tract is 535,826 acres and the other is 32,373.

. . . Standard Oil Co. of California, two concessions in El Peten. One tract is 39,412 acres and the other 160,005 acres.

. . . Amerada Petroleum Corp. of Guatemala, 584,599 acres in El Peten.

. . . Sun Production Co., a subsidiary of Sun Oil Co., 261,054 acres in El Peten.

. . . Standard Oil Co. (N. J.), 61,493 acres in El Peten.

The latest concessions granted made California Standard the first company to obtain four concessions. Union Oil and Petroleos Guatemaltecos each have three and Amerada, Sun, and Jersey Standard now have two each.

Bids Taken on French Line

The North Atlantic Treaty Organization is taking bids on a 275-mile products pipeline project in northwestern France.

The new network will cost an estimated $10,800,000, and will be one of the biggest NATO projects in which American firms have been permitted to participate.

Two-inch pipe will be used in two sections for 54 miles from Langres to Mirecourt, and 63 miles from Mirecourt to Phalsbourg. Three sections will have 8-in. line, 47 miles from Mirecourt to Metz, 30 miles from Phalsbourg to Deux Ponts, and 35 miles from Phalsbourg to Strasbourg.

ESSO
GOLDEN
ESSO EXTRA

MEET A MAN WE WORK FOR!

Chances are you thought it was the other way around. But this man—symbolic of 25,000 Esso Dealers—doesn't work for us. In fact, the shoe is on the other foot!

Actually he's our customer—a very important customer . . . an independent businessman who buys Esso products from us and resells them to you at his Esso Station. He chose the Esso Sign for a very definite reason. He believes that our products—together with our reputation and our methods of doing business—give him the best possible chance for personal success.

The records bear out the wisdom of his choice. Over 990 dealers have been with us 30 years or more. Another 3,021 have served you at the Esso Sign for over 20 years; still another 4,385 for more than 10 years. They could have sold another brand at any time, but they like the way we operate and the way you prefer the ever-improving products we supply—such as our new GOLDEN ESSO EXTRA.

So next time you stop in at an Esso Dealer's, look at him in a new light. He's doing an important job and he's doing it well. He's making his own way in a highly competitive business. And though we're dedicated to helping him in that business all we can, please remember this—your Esso Dealer may wear an Esso uniform . . . but he's in business for himself.

WHAT'S BEHIND THIS SUCCESSFUL RELATIONSHIP?

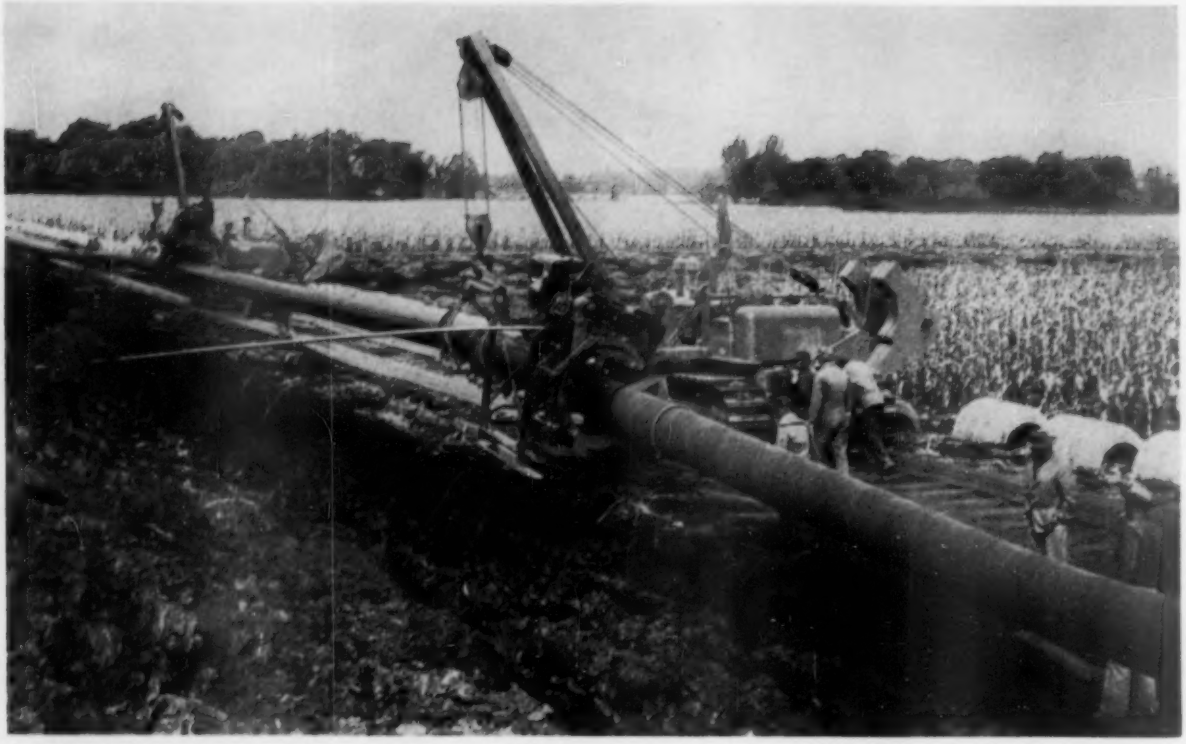
Because it might be of general interest, we highlight here some of the principles, unchanged throughout the years, under which we do business with the men who sell you our products:

- The motoring public is best served by the distribution of petroleum products through service stations operated by independent merchants.
- Our customers, the Esso Dealers, are free to run their businesses as they see fit.
- We do not enter into exclusive dealing contracts on gasoline, oil, tires, batteries or accessories. We try to sell our Esso Dealers on stocking and merchandising our Esso and ATLAS products because we feel it is to our mutual advantage that they do so.
- Esso leadership, through research, is assurance to our dealers that we will continue to supply them with the best in product quality.
- We know it is good business and, therefore, urge our dealers to maintain clean and attractive looking stations and to provide prompt and courteous service, because experience and consumer research have proved that these attract more customers.
- When we have the opportunity to deal with someone who has demonstrated his ability as a good merchandiser, we do so in preference to one who is neglectful of his business.
- Twenty percent of Esso Dealer outlets are owned by doctors, lawyers, widows, estates, legislators, educational institutions, and people in just about every walk of life. These we lease and, in turn, sublease to dealers. Seventy percent are either owned by the dealer himself or leased by him from others.
- We consult with representative groups of our dealers on new merchandising programs and dealer problems in order to obtain the benefit of their opinions and comments.
- We and our dealers are dependent upon each other for success. For this reason, we must work together in every possible way.

ESSO STANDARD OIL COMPANY

ESSO

This message appeared recently in newspapers in major cities in the area served by Esso Dealers



PLASTIC TAPE AND FELT outer wrap being wound on 22-in. pipe by the "dopeless dope gang" of Houston Contracting Co. during construction of American Louisiana Pipe Line Co.'s lateral line. Minimum equipment is advantageous on the temporary corduroy road along the right-of-way crossing a peat bog.

It's a "first" . . . and it's scored as a success

Long Pipeline Wrapped With Plastic Tape

by Paul Reed
Pipeline Editor

WHAT results may be expected in applying plastic tape to a long big-inch line? This question has just been answered in the recent laying of a 122-mile, 22-in. line by H. C. Price Co. and Houston Contracting Co. for American Louisiana Pipe Line Co. This line was entirely wrapped from end to end with Polyken—a plastic tape of polyethylene type. The company calls the project "a tie line" extending from its 30-in. line at Defiance, Ohio, to a connection with the Michigan Wisconsin Pipe Line Co. system at Bridgman, Mich.

All of the tape for the job was applied by the two spreads of the contractors in 35 calendar days of construction. Daily progress per spread averaged 9,100 ft. During this time the taping gangs consistently kept up with the fast output of the welders. From the time mechanical adjustments were completed at the start of the project, the taping application met all inspection requirements.

Successful application coupled with the advantages of this clean, smooth, simple technique bringing savings in labor, equipment, and job efficiency, indicates that plastic taping has promise of taking its place among the methods available to the industry for pipeline protection.

The higher cost of material appears to have been offset by reduced cost of application. For the 10-mile test run in May on American Louisiana's 30-in. line gave an opportunity for the company and contractors to consider all aspects of this innovation in pipelining.

American Louisiana's taping operations ran so smoothly that the account of work at the two spreads can be quickly told.

PIPELINING

Advantages of taping . . . In addition to the savings observed in the reduction of labor and equipment, there are probably intangible economies from closer coordination due to shortening of the spread. Among these might be included an over-all increase in production efficiency, for with such an ever-ready material, time loss never occurs at the wrapping machine. Behind the taping machine there is no pipe on skids beside long stretches of open ditch. Expenses are much reduced for materials handling.

Furthermore, hot-coating liabilities are eliminated. Likewise, there is no expense for damage to live stock.

Speed of taping operations . . . The work was divided evenly between Price

CLEANING MACHINE—applying no primer—is just ahead of the taping machine which is followed closely by backfilling seen behind.

and Houston, with each having 61 miles. Houston started on September 17 and Price on September 19. Taping operations of each spread took the same length of time—38 days. Both spreads finished during the week of October 22.

The speed of taping appears to be more than amply fast for construction needs. The only interruptions observed were for changing rolls. More important even than speed, however, is the consistency of daily work output. Even when delays occur for other operational reasons, because tape coating is ready to move ahead at an instant's notice, the contractor can count on making up much of his lost time. By day's end his backfilled footage can be consistently high.

Quality of application . . . Prior to this project, some difficulty was encountered on large-diameter pipe due to the mechanical introduction of wrinkles into the tape coating as it was applied. Improved and more stabilized wrapping equipment properly adjusted early on this job produced the required quality of application. After that, the standards of uniformity were satisfactorily maintained. There were no complaints regarding performance and none of the pipe had to be retaped.

Quality of the tape application is indicated by the fact that only 15 holidays were spotted in 78 miles by the Pearson detector operated after the pipe had been buried and backfilled. This amounts to only one holiday per 5.2 miles.

Very few holidays were found by the electronic holiday detector following immediately behind the wrapping machine. There were seldom more than five holidays per mile. Consequently there was no specific patching crew. Individuals from the tape gang were used to quickly slap on the few patches when they were needed.

During the writer's trip along construction of the Defiance-Bridgman tieline no wrinkles were seen in the tape and he was informed that they occurred only occasionally and at bends. With further mechanical refinements it is expected that these will be essentially eliminated. Present experience indicates that they are more of theoretical than practical concern, since they tend to disappear, particularly after backfilling.

Description of the tape material is as follows:

Tape material . . . No. 900 Polyken was used on the .281-in. and .312-in.-wall pipe comprising the largest part of the line. Nominal thickness of No. 900 Polyken is 12 mils—8 mils of film and 4 mils of adhesive.

No. 920 Polyken of 20-mil thickness (15-mil film and 5-mil adhesive) was used on the 0.375-in.-wall pipe laid at water and highway crossings, as well as within town boundaries.

For such locations double coating would have been specified if coal-tar coating had been used.

Polyken No. 900 rolls were 15 in. wide and 800 ft. long on 3-in. i.d. cores each weighing 75 lb. with 10 squares per roll.

Minimum overlap is ½ in., maximum is 1 in. Most of the tape was applied with the maximum 1-in. overlap.

In wrapping 22-in.-diameter pipe, 64.8 squares cover 1,000 lineal feet or approximately 15.5 lineal feet per square.

The basic material of Polyken is polyethylene. Film backing material is highly elastic. The Polyken adhesive is an important feature of the tape because it effectively eliminates need for a primer. A tough, tenacious adhesive covering of the tape results from the process of applying adhesive to the film between calendaring rolls under heat and pressure. The adhesive material itself is an inert synthetic.

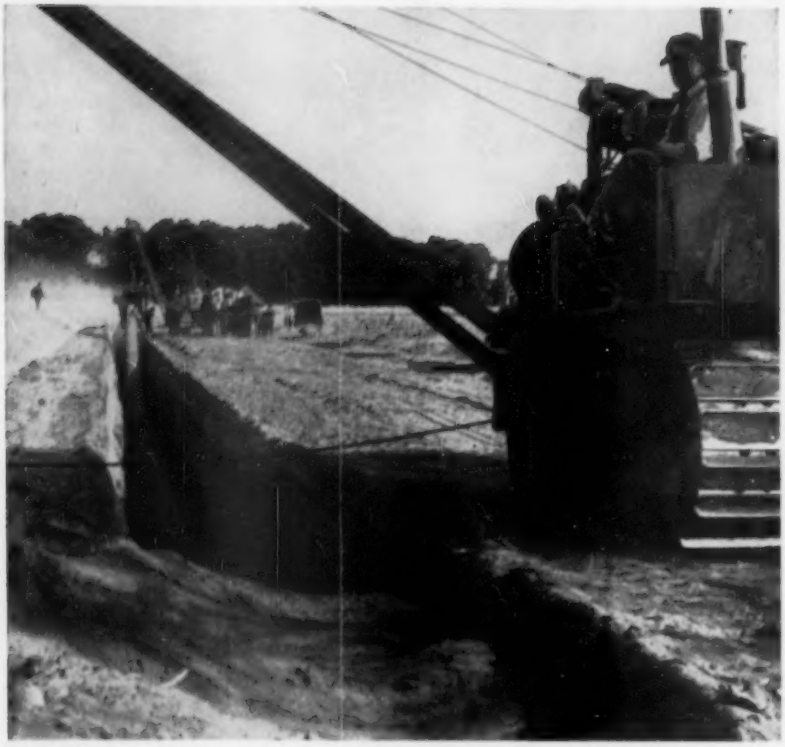
The plastic tape is protected by an outer wrap of Johns-Manville 8-lb. asbestos-felt-reinforced Transhield impregnated with coal tar. Reinforcement is provided by glass thread on ¼-in. centers.

Taping is done with specially built Remco power-operated wrapping machines which spirally wrap the pipe from two spools of tape and two spools of the glass-reinforced felt.

Costs . . . The net cost of Polyken tape is $6.90 per square when ordered in large quantities. For 22-in. pipe, Polyken material would cost approximately 45 cents per lineal foot.

High cost of the tape is offset by reduction in application costs which have been estimated to include a 45 per cent reduction in the units of labor in the section of the work from and including the cleaning machine through the taping gang and to and including the clean-up gang.

Specifically, the units of labor saved



BACKFILLING on the H. C. Price Co. spread immediately after the taped pipe is cradled into the ditch.

are reported to include 3 operators, 5 firemen, three truck drivers, and 22 laborers, totaling 33 saved. Altogether a total of 40 men are used in these rear-end gangs on a taping job as contrasted with a total of 73 men for such gangs on a spread where hot coating would be used.

The taping gang of one contractor had three boom tractors—for cleaning machine, taping machine, and catchoff. The other contractor's taping gang had four tractors. The additional tractor was between the cleaning machine and the taping machine.

One contractor used 14 men in the tape gang itself while the other had 11 men. In addition there were four men with the cleaning machine (operator, tractor driver, and two skid men) and three men with the backfiller (operator, driver, and swamper).

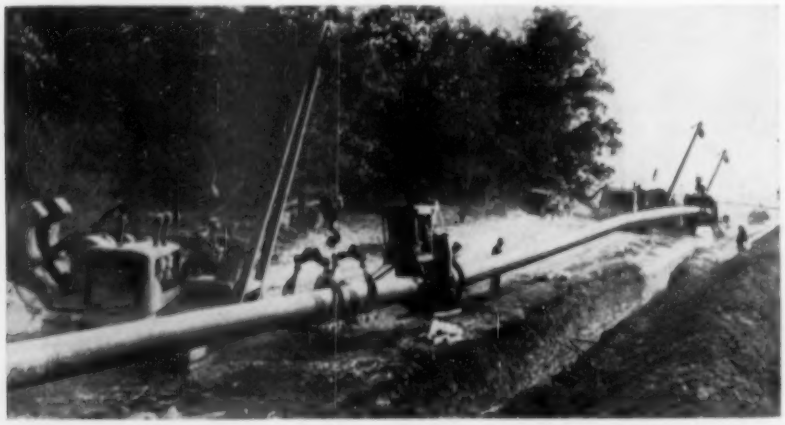
Hot-coating and wrapping gangs usually vary from 37 to 45 men and often have 42 men.

Shorter gangs . . . An impressive feature of taping is the short distance between operations for cleaning, taping, lowering-in, and backfilling which are all carried on within a stretch of a quarter of a mile or less.

In the near future operations may be even more compact. Improvements considered for the mechanical equipment include a scheme for linking the cleaning machine and the taping machine fairly close together with an intermediate vacuum cleaner to remove dust from the pipe.

Provisions for various conditions . . . When taping is done over pipe that has been flashwelded at the mill along the longitudinal seam, the weld upset is covered by a narrow strip of Polyken to protect against injury to the spirally wound tape.

On the 10-mile trial run near Memphis in May, certain small irregularities referred to as wrinkles were observed occasionally after the tape was wrapped on the pipe. They were easily smoothed out by slight pressure of the hands. After backfilling, these irregularities disappeared and the tape was seen to adhere to the pipe in a uniform manner. It is known that during the unwinding of tape rolls, especially at high speeds, the line at which the adhesive releases from the backing material normally fluctuates back and forth perhaps a half inch on either side of a midline. As a consequence of this tape motion, along with vibration and rocking of the traveling machine, a degree of fluttering is introduced into the tape and this is the source of the wrinkling irregularities. Since their source is mechanical—concerned both with smoothness of unwind of the tape roll and smoothness of equipment operation—it was apparent that they could be essentially eliminated by carefully controlling the unwind characteristics of the tape and by mechanical adjustments for unwind tension control and machine stabilization. While these irregularities were not regarded as detrimental, improvements were made in the technique, during the summer, which were effective on this job.



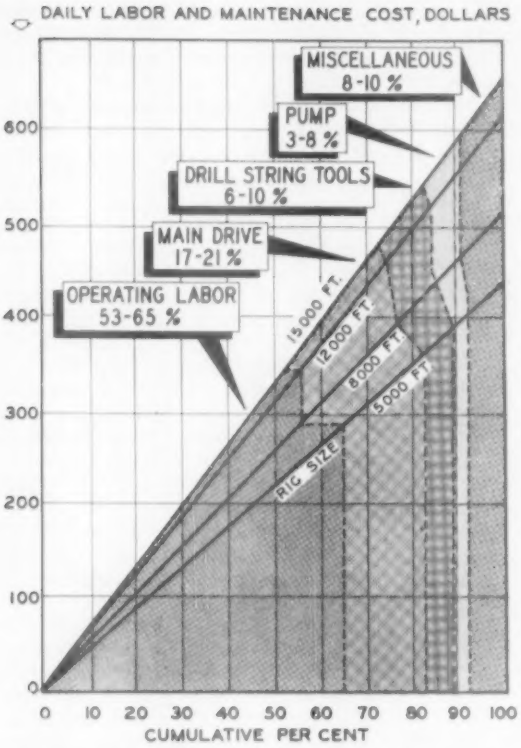
HANDLING OF SKIDS is minimized in the tight gang operations possible with taping. Catchoff tractor follows the taping machine.

Conclusions

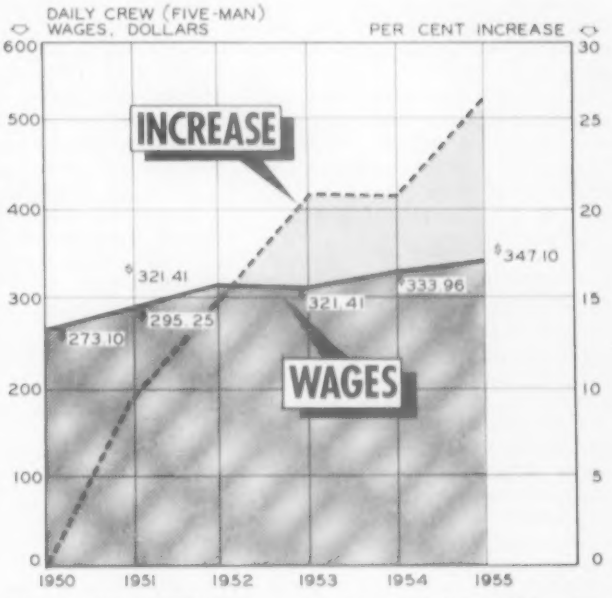
The effectiveness of Polyken for pipe protection has been tested extensively in recent years by a large number of companies in the wrapping of short sections of pipe at valves and field joints. For this particular purpose the material has had wide acceptance.

The taping of the American Louisiana 122-mile, 22-in. Defiance-Bridgman tie-line is the first step toward establishing plastic tape for full-scale pipeline construction.

Pipeline taping would follow the modern industrial trend which favors the completion of processing and subassemblies in advance of final assembly. The preparation of pipeline-protection material in manufacturing plants should facilitate the accurate control of quality and dimensions.



RIG MAINTENANCE and necessary crew labor account for a large part of rig operating expense. Note how drill-string tools and pump upkeep increase with rig size. Fig. 1.



HOW WAGES INCREASED over the 5-year period for which maintenance costs were obtained. To arrive at representative present-day costs the 1955 wages are used in the total shown in Fig. 1. Fig. 2.

Rig Upkeep Has Big Price Tag

by Robert W. True

Here are costs of operating labor and maintenance for rotary drilling rigs in four different depth classifications. Current labor costs represent over half of the total but maintenance expenses, averaged over a 5-year period, range from $150 to $320 daily. Extra engine horsepower has proved less expensive in the long run.

MAINTENANCE costs of drilling rigs are largely dependent on the size or depth of the rig. Records of Big Chief Drilling Co. for such costs, averaged for the years 1950 to 1955, coupled with current crew wages on rigs of four depth ratings are shown in Table 1.

This illustrates the fact that expense per horsepower decreases with increased rig-power capacity and shows an advantage for equipping rigs with greater than normal usable engine horsepower.

These maintenance costs are considered the result of good operation and maintenance practice. This practice includes the use of preventive maintenance schedules, periodic inspections, on-the-job training of crew members, planned and regulated lubrication, and up-to-date records on all operating machinery.

Author is with Big Chief Drilling Co., Oklahoma City. Paper presented at 1956 Petroleum Mechanical Engineering Conference of A.S.M.E., Dallas, Tex.

TABLE I—MAINTENANCE COSTS

Depth rating, ft.	5,000	8,500	12,000	15,000
Rated horsepower	450	750	1,350	1,620
Daily maintenance and labor cost, dollars	441.70	516.41	618.71	659.42
Daily cost per rated horsepower, dollars	0.98	0.69	0.46	0.40

Only a part . . . This article deals with maintenance costs only and does not include such other items of rig-operating expense as depreciation of capital investment, insurance, cost of supervision, overhead expense, rig-moving cost, fuel and water charges, taxes, cost of bits and consumable supplies, or trucking and transportation.

The costs vary with geographical location and geological conditions and are not considered maintenance expense. It should be understood, therefore, that the summation of maintenance costs presented here does not represent the total cost of owning and operating a drilling rig.

What's included . . . Our experience is limited to the operation of gas-engine rigs and only rigs of this type are considered. The mast or derrick and its substructures are essentially investment items and are subject to practically no maintenance.

Table 2 shows how various items contribute to maintenance costs. Specifications of the rigs in each depth range are shown also. Costs are divided

into five main groups as follows: crew labor, major drive group, drill string, mud pumps, and miscellaneous equipment. Fig. 1 shows the proportion of the total expense that each group contributes.

Since these costs are termed average for the years 1950 to 1955 one should realize the resulting figures do not completely represent present operating costs. One exception does exist, however. The rig-operating labor cost reflects the total expense at the present time. This was done in order that we might come as close as possible to the cost of operating these rigs in present drilling.

Operating Labor

To fully cover rig maintenance costs the necessity for adding rig operating labor to the actual maintenance and repair charges should be realized. Rig operating costs can be directly associated with the moral and efficiency of the drilling crews. The most-efficient and best-qualified crew men will work where they will receive the highest salary. Those workers of less know-how will fall in line accordingly.

In some active drilling areas, rig contractors use cheap labor to reduce operating costs, consequently reducing their bidding estimate for contract work. Subnormal rig-maintenance practices exist in such an operation and costly rig down time for needy rig repairs is frequent. In addition, the hazards while working under these conditions increase and result in an increase in injury frequency among the crew men.

In Table 2 labor costs vary $58.65 between the two smaller rigs and the 12,000 to 15,000-ft. class. This is because small rigs are operated with four-man crews and the larger rigs carry the customary five-man team.

One fact that has steadily increased rig operating charges is the gradual increase in wage rates. As shown in Fig. 2 labor charges for a five-man crew in 1950 were $273.10 per day and these same men received $347.10 while working in 1955. This represents an increase of 26.2 per cent in wage raises alone.

Main-Drive Group

The main-drive group is the heart of any drilling rig. The success of the drilling operation depends upon the maintenance procedures carried out on these units. This group represents 20 per cent of the total operation cost or 42 per cent of the machinery operating and repair expenditure, excluding labor.

TABLE 2—DAILY DRILLING-RIG MAINTENANCE EXPENSE

Depth rating, ft.	5,000	8,500	12,000	15,000
Number of engines	2	2 and 3	3	3
Rated horsepower*	450	750	1,350	1,620
Cubic inch displacement (all engines)	3,924	5,788	9,696	11,133
1. Rig operating labor cost	$288.45	$288.45	$347.10	$347.10
2. Main-drive group:				
Draw works	$10.99	$22.06	$24.20	$34.16
Compound	19.85	19.94	20.15	24.25
Engine-drive group	18.90	25.68	28.60	30.45
Chain	5.67	7.52	10.26	14.41
Oil and grease	20.48	31.06	30.85	28.61
	$75.89	$106.26	$114.06	$131.88
3. Drill string and tools:				
Slips, tongs	$4.07	$4.84	$6.29	$6.43
Block, hook, elevators	1.67	2.24	2.14	3.67
Swivel	1.94	2.22	5.22	5.28
Wire line	5.62	9.22	11.37	15.16
Rotary table	2.93	4.17	2.97	1.76
Drill pipe	2.86	5.27	9.27	9.30
Drill collars	3.85	14.44	16.23	18.40
Kelly subs	4.55	3.32	6.92	5.82
	$27.49	$45.72	$60.41	$65.82
4. Pump	$14.44	$26.71	$41.36	$50.43
5. Miscellaneous equipment:				
Air compressors, wire-line guides, rollers, swivels, rigup chain, etc.	$2.50	$6.86	$8.79	$10.95
Welding	4.99	7.57	5.78	8.31
B.O.P.	1.60	2.14	2.50	3.63
Electrical equipment	2.37	2.15	4.86	3.90
Rig supplies, wrenches, hand tools, pipe fittings, paint, etc.	23.97	30.55	33.85	37.40
	$35.43	$49.27	$55.78	$64.19
Total	$441.70	$516.41	$618.71	$659.42

*Maximum horsepower bare engine operating at sea level, 60° F. air temperature, rated r.p.m.

As shown in Table 2, items included in this group are: engines, draw works, compound (or transmission), and lubricants.

The primary concern of any rig operator is to receive the maximum amount of horsepower at the lowest possible rate. Therefore, it has been the policy of some operators to pack additional horsepower into a rig so that it can exceed its nominal depth rating. However, care should be taken not to exceed the pressure ratings of pumps, maximum draw works hoisting load, etc.

By having more horsepower available through the compound and drive group, the engines can be operated in a range well below their maximum horsepower output. This reduces maintenance expense.

Excess horsepower . . . Table 2 brings out the fact that rigs provided with excess horsepower can be operated at a reduced cost per horsepower used. On the 8,500-ft. rig supplied with 750 hp., the horsepower used in pumping operations is 515 or 67 per cent of the available total. The 15,000-ft. unit supplied with 1,620 hp. uses a maximum of 870 hp. or 53 per cent of total for drilling use. Cost per 100 hp. per operating day on the 8,000-ft. rig was $20.60. Corresponding expense per 100 hp. per operating day on the larger rig (15,000 ft.) was $15.05.

This constitutes a 22.3 per cent reduction in horsepower costs for the larger rig. The resulting comparison indicates that the smaller rigs should be equipped with more horsepower than presently available. It might be added that, since these figures were compiled in 1955, this drilling contractor has purchased a rig confirming these conclusions.

An 8,500-ft. rig was assembled having a drive unit (compound engines) of 1,080 maximum horsepower. It is our conclusion that this unit will have a lower daily operating cost than average powered with less than 900 hp. maximum.

If the 8,500-ft. rigs had been previously supplied with ample horsepower 5 years ago a notable saving could have been realized. In other words if these rigs could have operated at $15.05 per 100 hp., a savings of $8,700 would have been realized yearly. In addition, the savings would have paid for the investment cost for this added drive unit in 3 years. Also, the rig would have had additional horsepower for emergency use.

Drill-String Tools

The cost totals in Table 2 indicate that depth of a well has a great deal to do with the upkeep of the drill-string

tools. In this category we have included drill pipe, drill collars, wire line, rotary table, traveling and crown blocks, hook, tongs, swivel, and associated tools. However, close examination of the items listed, shows that the cost is primarily due to three items: wire lines, drill pipe, and drill collars.

Wire line . . . Investigating the wire-line costs further, we find the additional expense increase on the larger rigs are due to the ton-miles incurred while hoisting pipe. As shown in Table 4, the ton-miles at maximum depth for the 8,500-ft. rig is 204 compared to 481 for the 15,000-ft. tools. The wire-line cost per day on the larger rig is 2.1 times the medium-size unit. Records show that relative cost per ton-mile absorbed while hoisting differs only by $0.01 ($0.097) for the 8,500-ft. and $0.086 for the 15,000-ft. rig.

Drill pipe . . . Many factors affect the daily expense of drill-pipe costs. In the case of the two larger rigs, they were used on wells where crooked-hole conditions existed. Therefore, abnormal tool-joint wear was present which in turn necessitated the premature building up of the tool joints with tungsten carbide to prevent total tool-joint destruction.

However, even though this pipe was exposed to those conditions the total life of the drilling string was not affected. Normal drill-pipe expense for rigs of such size (12,000 and 15,000 ft.) would be approximately $7.55 per day and on the smaller units an average operating expense of $4.20 is expected.

Drill collars . . . Drill-collar expense can vary greatly from well to well for any size rig. This is primarily due to the casing and hole-size program. A rig operating in areas where controlled deviation of the hole is necessary must use drill collars of additional size and weight, i.e., 9⅞-in. hole and 8-in. collars, etc. Under these circumstances high tool-joint repairs exist.

But well costs compiled on units drilling in areas where the well bore does not deviate greatly, i.e., 9-in. hole, 7-in. collar, show lower drill-collar expenses.

It is common practice to use longer drill-collar strings on the larger rigs to increase penetration rates in the harder formations encountered at the greater depth. Therefore, the over-all cost of drill-collar maintenance depends upon these points: size of hole being drilled, the depth of the well, use of oversize collars, and need to carefully control deviation.

TABLE 4—WIRE-LINE EXPENSE

Depth rating, ft.	5,000	8,500	12,000	15,000
Hoisting load at maximum depth, lb.	105,000	162,000	225,000	265,000
Ton-miles per trip with drill string	98	204	340	481
Cost per ton-mile	$0.097	$0.097	$0.086	$0.086
Wire-line cost per trip	$9.50	$19.20	$29.25	$41.50

TABLE 5—CALCULATING HORSEPOWER VS. OPERATING EXPENSE

Depth rating, ft.	5,000	8,500	12,000	15,000
Horsepower available to draw works and pumps	450	750	1,350	1,620
Total cubic inch displacement of engines	3,924	5,788	9,696	11,133
Horsepower rating of main pump	350	619	825	825
Maximum horsepower delivered to main pump at rated total depth	235	415	525	690
Cost per day per pump	$14.44	$26.71	*$34.50	*$42.20
Cost per day per 100 hp. delivered	$6.10	$6.40	$6.60	$6.10

*Allowance made for additional pumps used on larger rigs.

Mud Pumps

The effect of higher operating pressures on mud-pump costs is clearly indicated in Table 5. Rigs operating in the shallow depth range have greatly reduced costs due to the lighter load incurred during pumping and drilling operations. The increase in horsepower requirements is almost doubled from the 5,000-ft. rig to the 8,500-ft. rig. Consequently, the pumping cost per day reflects the higher trend.

Because the larger size rigs have two and sometimes three pumps for circulation purposes allowances have been made in Table 5 to conform to cost of operating one main circulating pump during drilling operations.

In recent years the main pumps have been paralleled in the initial drilling operations. This operation does not materially increase the daily operating costs due to the small percentage of time consumed in this operation as compared to the total drilling days consumed in drilling deeper holes.

Average pump operating costs of this report does not reflect the increase in pump expense resulting from jet-bit drilling and high pump pressures resulting from this operation. These mud pumps were not used to any great extent for jet drilling prior to 1953.

TABLE 3—COST OF HORSEPOWER DURING DRILLING OPERATIONS

Depth rating, ft.	5,000	8,500	12,000	15,000
Horsepower available to draw works and pumps	450	750	1,350	1,620
Total cubic inch displacement of engines	3,924	5,788	9,696	11,133
Maximum horsepower used at rated total depth during drilling operations	295	515	669	870
Cost per 100 hp. delivered per day	$27.5	$20.6	$17.2	$15.05
Per cent of maximum horsepower available in use	65.2	67.0	49.5	53.0

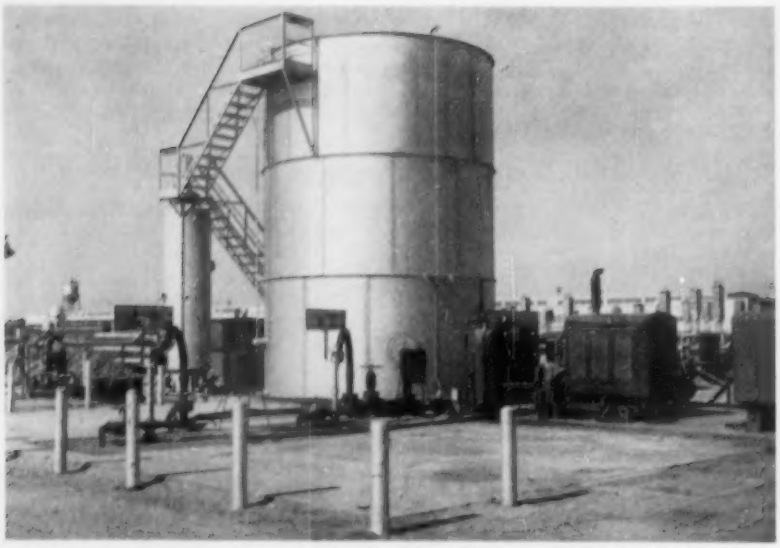
The 12,000-ft. rig class reflects the upsurge in operating costs due to this procedure. In 1950, the cost of operating an 825-hp. pump for normal drilling operations was $29.71 per day. This same pump took $57.80 per day to operate in 1955. True, some of the operating cost rise was due to the increase in charges for replacement parts, but most of this increase is due to the increase in horsepower input necessitated by jet-bit drilling.

Miscellaneous Equipment

The final group of costs appearing in Table 2 consisting of the remainder of expenses incurred during drilling procedures. These cover auxiliaries and accessories such as air compressors, electric equipment, blowout preventers, paint, hand tools, etc. As illustrated in Fig. 1, these costs constitute 8 to 10 per cent of the total operational expense. Closer examination of these costs reveals that general rig supplies (hand tools, wrenches, valves, drill-pipe fittings, etc.) constitute approximately 60 per cent of the total miscellaneous costs.

While this group (general rig supplies) should be high due to the excessive turnover in these items; Big Chief conducted a campaign to try to reduce this expenditure. In 1953, the average cost of these miscellaneous tools for all the rigs was $37.61 per day and 1 year after our campaign was initiated (1954) the costs were reduced to $28.92. In 1955 a further decrease reduced the cost per day to $23.80 per rig.

This is just one of the many programs adopted to try and regulate or even reduce operational costs. The increase in cost of equipment does tend to raise operating expenses. But in most cases, with proper purchasing control and effective rig maintenance, these expenses can be regulated and normal cost of operating these rigs can be maintained.



BOTH INJECTION WELLS for the Terminal zone flood are slanted from Pier B, adjacent to one source well. Some of the four engine-driven triplex injection pumps are shown at right.

SEA-WATER WELL, one of three, is protected from corrosion by magnesium anodes.

Wilmington flood-project operators show gains in

Battle Against Ocean-Water Corrosion

Cathodic protection and use of corrosion-resistant materials stop trouble in shallow water-source wells

by Charles H. Jones, Jr.

THREE years of experience with a trial flood in the harbor area of Wilmington field, carried out by Long Beach Oil Development Co., has shown that corrosion is a major problem when sea water is used for water flooding.

The flood was the first on the West Coast to use sea water and little was known at first about how serious corrosion would be. Protective methods thus have had to be developed as the problems arose.

Cathodic protection and use of corrosion-resistant materials have practically stopped corrosion in the shallow water-source wells. Limited tests have failed to disclose a completely satisfactory inhibitor but use of inhibitors appear to be the best method for protecting injection wells.

Sea-water source . . . The injection program was started in June 1953, for the purpose of determining the feasibility of carrying out a full-scale flood. Only one source well and injection well were used at the start but a month later a second injection well was added. Since then three more source wells have been drilled. Because of excessive sand entry through enlarged perforations the original source well was abandoned in 1955.

All source wells were drilled on Pier B, near the surface location from which the injection wells were slant drilled. Bottomed at depths of 122 to 200 ft., the source wells were completed as shown in Table 1.

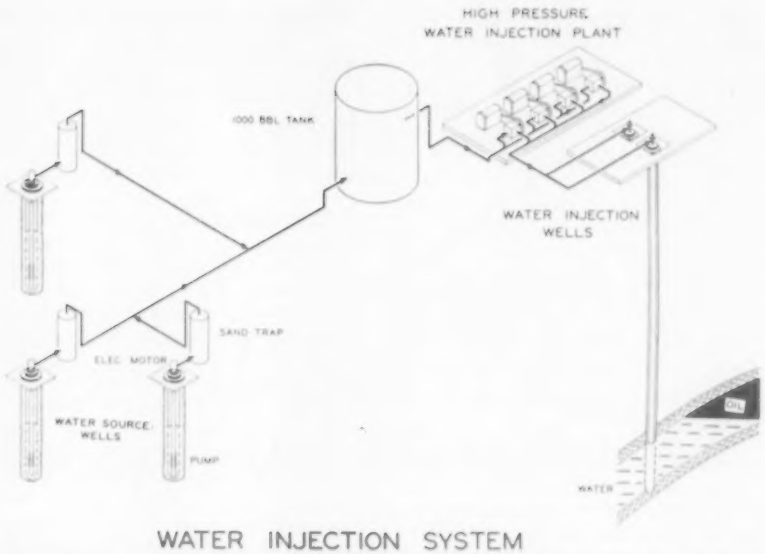
Production rates of the source wells varied considerably. The most productive was B-4, which had a maximum potential of 45,000 bbl. daily. At a fluid level of 47 ft. (top of perforated interval), it showed a potential of 19,000 bbl. daily. Only two of the wells, B-3 and B-4, are needed to meet current water requirements of approximately 15,000 bbl. daily.

Analyses of the water shows that it compares very closely to that of sea water. It is relatively oxygen free (less than 1 p.p.m.) and is free of algae, sea weed, etc. Turbidity is approximately 2 to 3 p.p.m. so that no filtering is required. A geochemical analysis of the

TABLE 1—COMPLETION DATA ON WATER-SOURCE WELLS

Well	Total depth (ft.)	Surface pipe (in.) and depth (ft.)	Liner hole size (in.)	Liner size (in.)	Perforated interval (ft.)	Size perfs. (mil)	Gravel size, Tyler mesh
B-1	122	None	24	11¾	47-49 67-71 116-122	40	12-14
B-2	124	42 at 42	40	16	43-112	60	6-8
B-3	200	30 at 25	28	12¾	44-192	60	8 mesh at ⅞-in.
B-4	200	36 at 25	34	12¾	47-151 161-195	70	6-8

PRODUCING



WATER INJECTION SYSTEM

SCHEMATIC DIAGRAM showing how ocean brine from three shallow wells is filtered and injected through two flank wells at the Wilmington water flood.

water produced by well B-3 is given in Table 2.

Flood wells . . . The two injection wells were slant drilled to the 3,000-ft. "Hx" sand in the upper Terminal zone in which the project is being carried out. One is bottomed on the north flank and the other on the south flank of the 65-acre pool. Both are injecting down-flank from the oil-water interface.

Both wells were completed as follows: After 12¾-in. surface pipe was cemented at 354 ft. a 10⅝-in. hole was drilled to total depth and 7-in. casing set. The 7-in. casing then was gun perforated over a 60-ft. interval, using ⅜-in. burrless bullets spaced one per foot. After 2½-in. tubing was landed above the shot holes, water was started down the tubing.

Injection pumps consist of four triplex units, each capable of an output of 5,000 bbl. daily at 1,000 psi. To prevent corrosion the pumps have porcelain plungers and aluminum-bronze liners. As of last July 1, almost 8,000,000 bbl. of water had been injected into the two wells.

When injection was started, sequestering agents were added to prevent the precipitation in the formation of barium and strontium sulfate. Polyphosphates were introduced on the suction side of the triplex pumps. When it subsequently was found that no serious plugging occurred with untreated water, use of the chemicals was stopped.

TABLE 2—CHEMICAL ANALYSIS OF WELL WATER

Radicles—	Milligrams per liter	Grains per U. S. gallon	Reacting value	Per cent
Sodium	10,525.7	614.82	457.7	39.54
Calcium	414.4	24.21	20.68	1.79
Magnesium	1,221.0	71.32	100.42	8.67
Iron	0.2	0.01		
Sulfate	2,800.0	163.55	58.30	5.04
Chloride	18,295.8	1,068.68	515.94	44.57
Bicarbonate	271.5	15.86	4.45	0.38
Borate	8.7	0.51	0.11	0.01
Silica	6.3	0.37		
Salinity (as NaCl)	30,162.3	1,761.8		
Total solids	33,543.6			
Loss on ignition	4,900.0			

Specific gravity at 60° F.	1.025
Resistivity, ohm.-cm. at 75° F.	19.6
pH	7.6

Groups—	Per cent	Chemical character—	Per cent
Alkalies	39.54	Primary salinity	79.08
Earths	10.46	Secondary salinity	20.14
Strong acids	49.61	Primary alkalinity	
Weak acids	0.39	Secondary alkalinity	0.78

Note: Sample contained no ammonium, barium, strontium, carbonate, or iodide.

Where corrosion occurred . . . First visual evidence of the corrosion problem was noted when the 5-in. tubing and turbine pump were pulled from well B-1 in July 1953, 5 months after the well was completed. Interior and exterior of the tubing and the pump case were completely coated with corrosion byproducts.

During the shutdown of the source well one injection well was swabbed in an effort to increase its injectivity. A sample of the water recovered contained about 1 per cent by volume of a precipitate. Analysis showed it to contain 87.4 per cent $Fe(OH)_3$, 1.87 per cent $Fe_2(SO_4)_3$, and 0.96 per cent FeS.

Other evidence of the corrosion problem pertained to the original turbine pump run in well B-1 in May 1953. Because cast-iron components of the pump were graphitized, it had to be discarded as irreparable in July 1954.

The well was abandoned in April 1955 because of severe liner damage. The liner was recovered and found to be very badly corroded. The open perforations, originally 0.040 in., were enlarged to 0.25-0.625 in. Over 50 per cent of the perforations were found to be plugged; these were not greatly affected by corrosion.

Corrosion of tubing in the injection wells also became evident. The 2½-in., 6½-lb., J-55 tubing run in one well in July 1953, had to be removed from service in October 1954. During this period it had handled 828,142 bbl. of brine.

Three joints of the tubing were split open for inspection. The wall thickness at equal distances along the tubing section was measured. Using this thickness versus the average of new tubing a corrosion rate of 13.2 m.p.y. (mils penetration per year) was calculated. This rate is probably low because the small pits could not be taken into consideration. The 2½-in. string later was replaced with 3-in. plastic coated tubing.

THE AUTHOR

Charles H. Jones, Jr., is production operations engineer for Long Beach Oil Development Co., Long Beach, Calif. He had 6 years' experience in the development engineering department before receiving his present job. In 1949 Jones was graduated from the University of Southern California with a B.E. degree in petroleum engineering. He has worked for Long Beach Oil Development since his graduation.

Now the two injection wells are so badly damaged that tools cannot be run through the injection interval. Chunks of shale 3 in. in diameter were recovered during recent operations on one well, indicating very enlarged perforations or possibly ruptured pipe. A survey run on the 7-in. casing at that time indicated a 3/32-in. reduction in the wall thickness of some joints.

Protecting source wells . . . With corrosion definitely established as a major problem, protective measures were started. Upon the recommendation that cathodic protection be applied to the source wells, the following data were collected in studying possibilities of the method:

1. Sample of unsaturated soil near water-source well had resistivity of 28,000 ohm-cm. Saturating the soil with water from source well B-2 gave a resistivity of 23 ohm-cm. Resistivity of the saturated soil indicated cathodic protection had merit for the section of the liner below the water table.

2. Electrical potentials between the various wellheads in the system using a copper-copper sulfate cell as a reference indicated no electrical exchange between different parts of the system was occurring.

To determine the benefits of cathodic protection on the source-well liners, a test was made simulating the conditions under which the liner was operating. Two perforated plates were installed on a bypass from source well B-2. Flow of the water was controlled so that the rate of flow through 1 sq. in. of perforations of the plate would be equivalent to flow through 1 sq. in. of perforations of the liner. Both plates were accurately weighed and one of them was insulated and cathodically protected. Applying various current densities to the protected plate gave the results shown in Table 3.

Because of the results of these tests, magnesium anodes were placed in the harbor water close to the source wells and attached to the source-well casing.

The anodes did not provide sufficient changes in potential rapidly enough. Thus a welding machine was temporarily used to apply a high current density for a short period to the source-well casing. This was done to hasten polarization at the casing, thereby reducing the required potential for continuous protection.

The anodes appear to be providing cathodic protection to the source-well casing. In September of last year, work on the extension of Pier B caused protection to be temporarily halted. Shortly before the interruption, potential of the water-source-well casing to the ground was measured at —0.82 v. (using a Cu-$CuSO_4$ cell as a reference). The original measurement, before protection, was —0.64 v. and the desired degree of protection was —0.85 v.

The recent design of the water-source wells, using corrosion-resistant materials, has lessened their problem, however. Plastic-coated liners and tubing are now run. Corrosion-resistant materials are used in the turbine pumps and in lines to the injection pumps.

Chemical inhibitors . . . An attempt to curb corrosion in the injection wells, in August 1953, an arsenic compound was injected down the annulus of the water-source well at an 11-p.p.m. concentration. Based on insulated coupons, it resulted in the corrosion rate dropping from 11.2 to 0.8 m.p.y. during a 25-day test. No further tests were made with the chemical.

No inhibitors were used in the latter part of 1953 and early 1954. During the next year, prior to March 1955, two other chemicals were tested. Sodium hydroxide was used to increase the water pH but tests showed it failed to decrease the iron and sulfide content of the water. Sodium hypochlorite (NaClO) also was tested but was found to have no effect on the corrosion rate.

In March of last year, use of unin-

TABLE 3—TEST DATA UNDER SIMULATED WELL CONDITIONS

Test No.—	Duration of test (days)	Current density (ma. sq. ft.)	Corrosion rate (m.p.y.)	Remarks
Protected plate:				
1	14	238	10.8	Light calcareous deposition
2	15	129	9.4	No calcareous deposition
3	14	17	4.33	Thin, black, hard deposition around extreme outer edge of exposed portion
Unprotected plate:				
1	14	0	33.6	Thin, black, hard deposit covering all exposed surfaces
2	15	0	29.5	.....
3	14	0	28.8	.....

TABLE 4—RESULTS OF VARIOUS CHEMICALS ON INJECTION-WELL CORROSION

Period—	Type chemical	Concentration p.p.m.	Where injected	Results (corrosion rates of steel coupons in m.p.y.)
July 19 to Aug. 17, 1955	Water soluble cationic organic liquid	8	Annulus of well B-3	Insulated 0.37; uninsulated 0.82 (96 per cent reduction).
Aug. 17 to Sept. 20, 1955	Same as above	11	Annulus of well B-3	Two tests: Insulated 3.3, uninsulated 42.7; insulated 2.7, uninsulated 23.7.
Sept. 20 to Oct. 4, 1955	Organic and inorganic compound	18.5	Surface of well B-3	Insulated 3.7; uninsulated 43.2 (18 per cent reduction).
Oct. 28 to Nov. 10, 1955	Amine type in alcohol solvent	*12.7	Surface of well B-3	Insulated 1.9; uninsulated 5.2 (90 per cent reduction).
Dec. 2, 1955 to Feb. 8, 1956	Same as above	*13.9	Surface of well B-3	Based on three test periods: Insulated 3.2, 7.5, 2.5, 1.3; Uninsulated 8.0, 69.2, 81.5, 54.8
Dec. 23, 1955 to Feb. 28, 1956	Modified chromate	28	Surface of well B-4	Insulated 4.3; uninsulated 8.6 (65.5 per cent reduction).
Feb. 12 to Apr. 9, 1956	Cationic organic liquid	20	Annulus of well B-3	Insulated 24.8, uninsulated 100.9; insulated 2.9, uninsulated 38.4 (26.9 per cent reduction).
Apr. 9 to June 14, 1956	Same as above	20	Annulus of well B-3	Installed additional set of coupons (60 to 98 per cent reduction): Original—Ins. 18.4, 1.0, 1.3, 1.5; Unins. 76.4, 2.5, 20.5, 7.3; New—Ins. 1.0, 1.0, 2.1, 2.3; Unins. 31.9, 0.8, 11.7, 10.4

*Injected over 8-hour period at three times concentration shown.

sulated coupons in the system was started as a means of evaluating the effectiveness of inhibitors. Tests made at well B-3 while no inhibitor was being used revealed a corrosion rate of 1.5 m.p.y. for the insulated coupon and 19.3 m.p.y. for the uninsulated one. A series of tests in well B-4 earlier this year yielded corrosion rates of 5 to 44 m.p.y. on the insulated coupon and 68.4 to 287 m.p.y. on the uninsulated coupon.

A chronological record of the various inhibitors used in the injection wells during the period July 1955 to June 1956 is given in Table 4. As shown, some chemicals resulted in reducing the corrosion rate by 50 to 95 per cent, based on uninsulated coupons.

Evaluation of the effectiveness of corrosion inhibitors using steel coupons indicate the inhibitors provide substantial corrosion protection.

Additional tests of inhibitors in down-the-hole conditions are being made with special tubing nipples placed in tubing string of one of the injection wells. Accurately measured and weighted, these nipples will be used for determining the down-the-hole corrosion rate while testing the more promising inhibitors.

Oklahoma City Wilcox Reservoir Has Highly Saline Flood

THE Oklahoma City South Wilcox sand unit is an area in the south end of Oklahoma City field that was unitized December 1, 1955, by Cities Service Oil Co., Sinclair Oil & Refining Co., Phillips Petroleum Co., and Continental Oil Co., with Cities Service being the operator.

The area is approximately 1 mile wide by 4 miles long and is comprised of 2,160 surface acres. After recovering some 55,000,000 bbl. of oil from the unit area, the owners expect to recover an additional 10,000,000 bbl. by water flooding.

The Oklahoma City Wilcox reservoir was discovered upon completion of the Cities Service Mary Sudik on March 26, 1930. "Wild Mary" was headline news all over the world at that time but soon slid into oblivion and has been temporarily abandoned for several years. Operators of the Oklahoma City South Wilcox sand unit anticipate that Wild Mary will be producing again in the not-too-distant future.

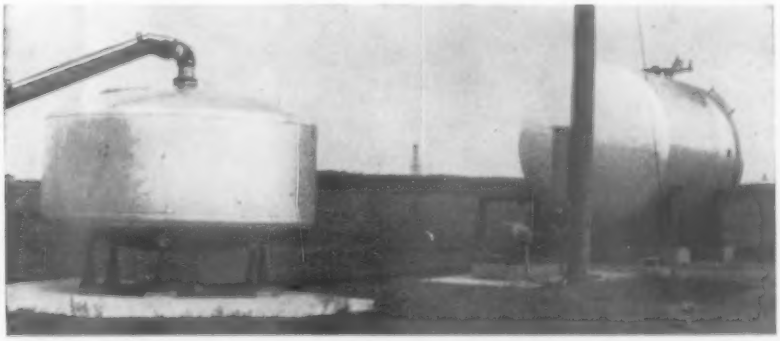
Reservoir type . . . The Wilcox reservoir is of Ordovician age and was formed by the overlap of Cherokee shale on a truncated anticline that is found at a depth of 6,500 ft. The average thickness before truncation is 225 ft. There is approximately 153,030 acre-feet of oil saturated sand that has produced 55,000,000 bbl. of oil for a recovery of 357 bbl. per acre-foot. The producing mechanism was originally solution-gas drive and was later supplanted by water expansion. Since about 1939, the principal driving mechanism has been gravity segregation.

Flood prospects . . . A pilot flood using an edge-water drive was started shortly after the unitization date. One injection well has been drilled and approximately 6,000 bbl. of water per day is being injected 2,000 ft. downdip well below the original oil-water contact.

By using the edge-water-drive type of flood, each injection well will affect a large area and a minimum of injection wells will have to be drilled. At the present, there are 47 producing wells and 1 water injection well in the unit.

The injected water is gathered from the producing wells with a fairly even balance being maintained between produced water and injected water. As the flood is expanded, additional water is available from producing wells to the north of the unit area.

The water is very saline having some 220,000 p.p.m. salt but is considered relatively noncorrosive if kept air free. All water is gathered through closed systems and every effort is made to keep the water from becoming aerated. An 8,000-bbl. per day pressure filter using anthracite coal as a filter media is used to trap the nondissolved solids. No other treatment is made at this time.



CLOSED SYSTEM for Oklahoma City's highly saline brine flood consists of an 8,000-bbl. per day anthracite-coal filter, left, and surge tank. Injection water is gathered from producing wells through closed systems to keep air out and corrosion down.

BOOKS

ROCKY MOUNTAIN OIL DIRECTORY. Published by Rocky Mountain Oil Reporter, P. O. Box 1528, Denver. Pocket-size, 200 pp.

This annual edition contains a series of maps showing the location of hundreds of oil and gas fields in Wyoming and the various booming basins including the Williston, San Juan, and Denver-Julesburg basins.

Oil and gas companies active in the mountain and the prairie states make up the largest section in the oil directory. Drilling contractors form the next largest group, followed by geophysical contractors, engineering and geological consultants, equipment and supply houses, and other specialized groups.

INTRODUCTION TO MICROFOSSILS, by Daniel J. Jones. Published by Harper & Brothers, 49 East Thirty-third Street, New York 16. 406 pp., $6.50.

This is the first published text on micropaleontology, and it should prove a "must" for every geological library. It is broad in scope and practical in its application.

The author describes various methods of collecting, separating, and mounting microfossils. He describes and illustrates all the major plant and animal groups, spores, pollens, etc. Of special interest is an extensive discussion of the environmental significance of the various forams, their stratigraphic distribution, and the applications of their study to practical exploration problems.

Illustrations are outstanding and include about 100 plates showing more than 1,000 fossil forms.

A STUDY OF THE WATER CONTENT OF A SILICA-ALUMINA CATALYST AND ITS COMPONENT OXIDES by R. G. Haldeman and P. H. Emmett. Available free from Mellon Institute, 4400 Fifth Avenue, Pittsburgh 13.

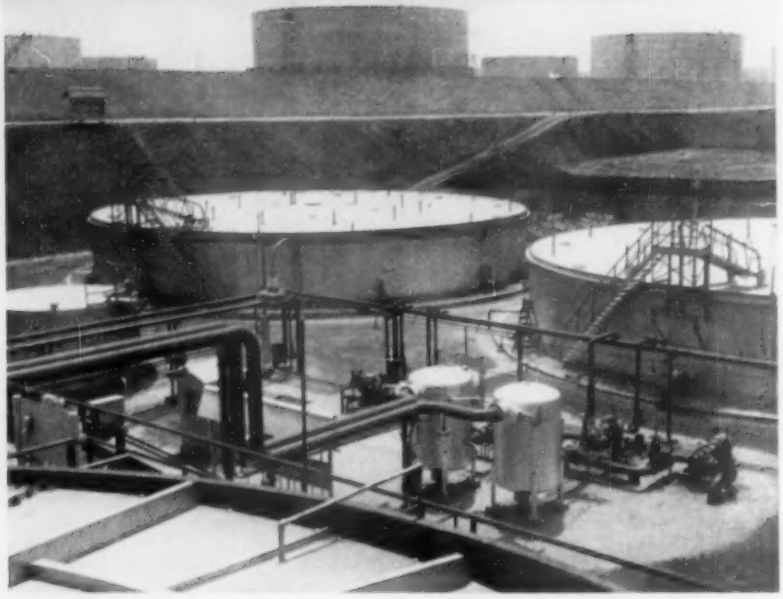
EXCHANGE OF HYDROGEN BETWEEN ISOBUTANE AND A DEUTERATED CRACKING CATALYST by R. G. Haldeman and P. H. Emmett. Available from Mellon Institute, 4400 Fifth Avenue, Pittsburgh 13, without charge.

Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.

REFINING

by D. H. Stormont
District Editor

Air Flotation Used to Separate Oil at Richfield's New Waste-Water Plant



OIL PRESKIMMING is carried out in the two 26,500-bbl. floating-roof tanks. En route to the flotator cells the waste water is given an injection of 40-psi. air just before it enters the two small dwell tanks.

A UNIQUE, compact treating plant which uses floating-roof tanks for preskimming and dissolved-air flotation cells for removing most of the remaining oil is effectively handling waste water at the Los Angeles refinery of Richfield Oil Corp.

Use of circular preskimmers was dictated by the stringent air-pollution-control regulations in effect in the Los Angeles area. Conventional A.P.I. gravimetric separators are not particularly suited to vapor-recovery operations, with which the new facilities are equipped.

Principal advantage of the dissolved-air flotation method is the short retention time required—only some 20 minutes. Designed over-all retention time of the waste water is about 4 hours.

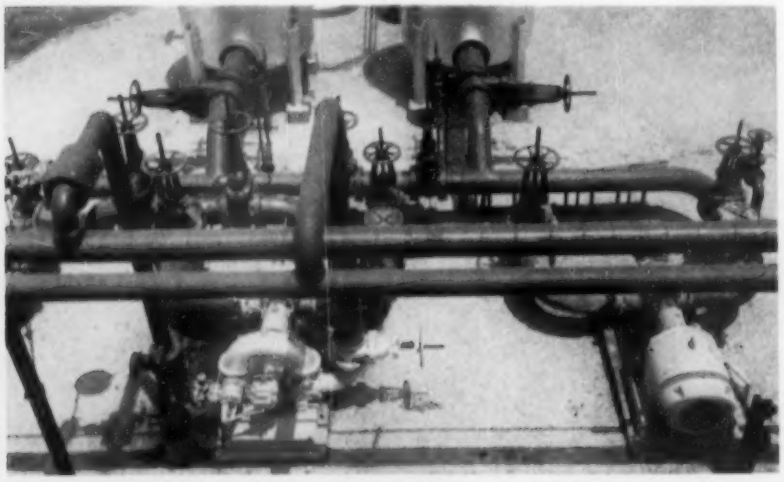
Ability of the flotation cells to handle a high volume of water per unit size makes for low treating costs. Initial cost of the new facilities was approximately $165,000. Including depreciation, cost of removing the oil is about 2.5 mills per barrel of water.

Influent currently is between 65,000 and 70,000 bbl. daily. An average of 500 to 600 bbl. daily of free oil (dry basis) is being recovered. Other than for pH control, no chemicals are being used.

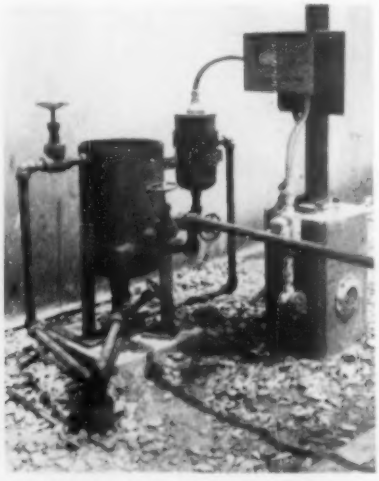
Influent to the clari-flotators contains approximately 100 to 125 p.p.m. of dissolved and free oil, as determined by the Hart U-tube method. Total oil content of the effluent is from 30 to 45 p.p.m. This is well below the 75 p.p.m. maximum specified in Los Angeles County waste-water ordinances.

The flotation process has no effect on inverse phase emulsions. Discharge from the clari-flotators is substantially oil free, but on occasions some dissolved oil will break out if it has been held in solution with either sulfonates or aromatics.

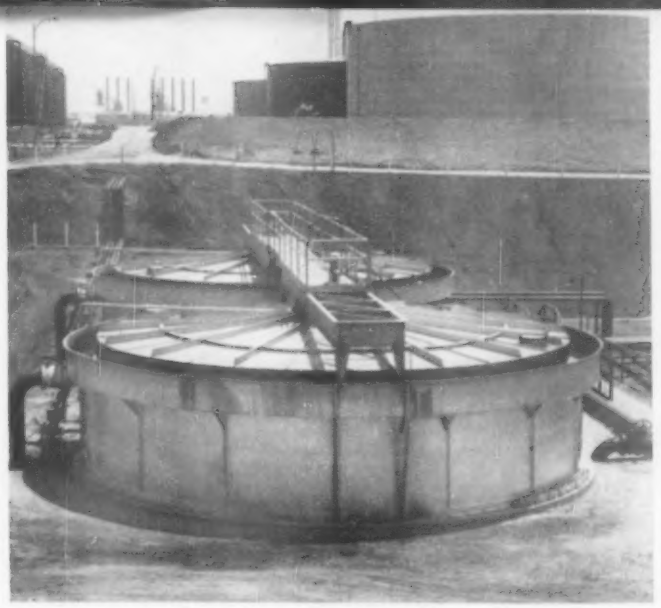
Dissolved air flotation apparently causes no reduction in either the biological oxygen demand or chemical



CENTRIFUGAL PUMPS charge the preskimmed water to the clari-flotators. Air is injected just before the water enters the dwell tanks.



pH ANALYZER in line to preskimming tanks indicates whether chemicals should be added.



FINAL SKIMMING is carried out in two clari-flotators. Although the retention time is only some 20 minutes, oil content is reduced to 30-45 p.p.m.

CLEAN WATER, freed of oil by the rising air bubbles, passes over weirs to an encircling launder.

oxygen demand. Presence of sulfides in the water offers no problem.

Layout of plant . . . The accompanying simplified flow diagram (Fig. 1), and some photographs, show the layout of the new treating facilities. All waste water flows to either of two 26,500-bbl. settling tanks where some free oil and sludge are removed. From there the water is pumped to the two 1,400-bbl. flotator tanks, en route receiving an injection of 40-psi. air. Freed of substantially all oil, the water goes to the disposal system. Skimmed oil is run to a slop-oil storage tank. Sludge is returned to the preskimming tanks.

Waste waters handled consist of the accumulator and sump waters from combination and thermal cracking units, catalytic cracking and reforming units, alkylation and polymerization plants, superfractionation unit, and from vacuum stills and an asphalt plant. Also included are waters from cooling tower blowdown, steam-stripped sour waters, spent caustic solutions which have been steam and air stripped, and those bled from storage tanks.

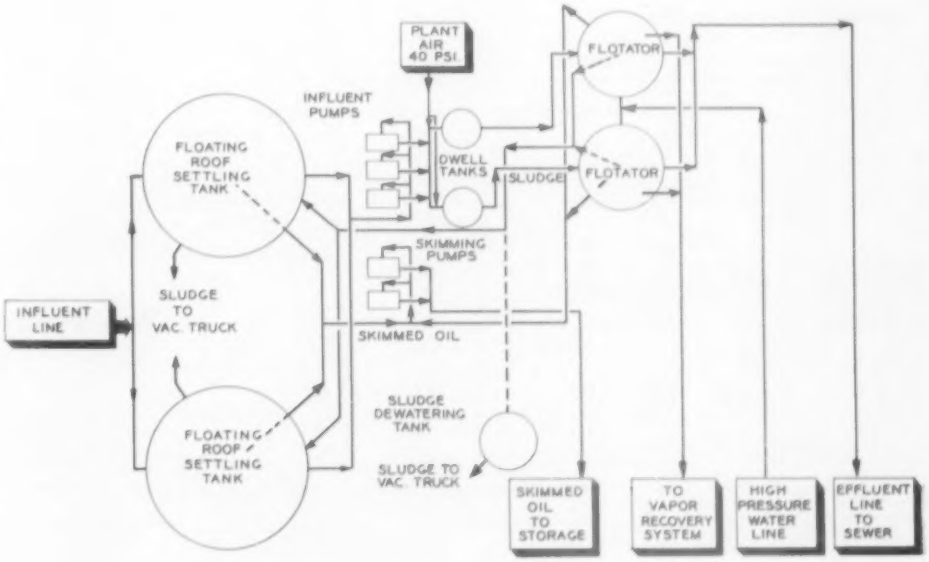
The 24-in. wastewater line is connected to both preskimming tanks so that they can operate in parallel or can take entire load while the other is shut down for sludge removal. Inside the tank a 24-in. tee swedges down to two 16-in. headers, each 16 ft. long (see Fig. 2). Water enters tank with a minimum of turbulence through 6 and 8-in. holes cut at intervals in the headers.

Oil separating during the approximately 3½ hours retention is skimmed through a 4-in. suction line near the center of the 90-ft. diameter tank. With the inlet fixed 3-in. below the base of the floating roof, three swing joints allow the oil suction line to rise and fall with the deck.

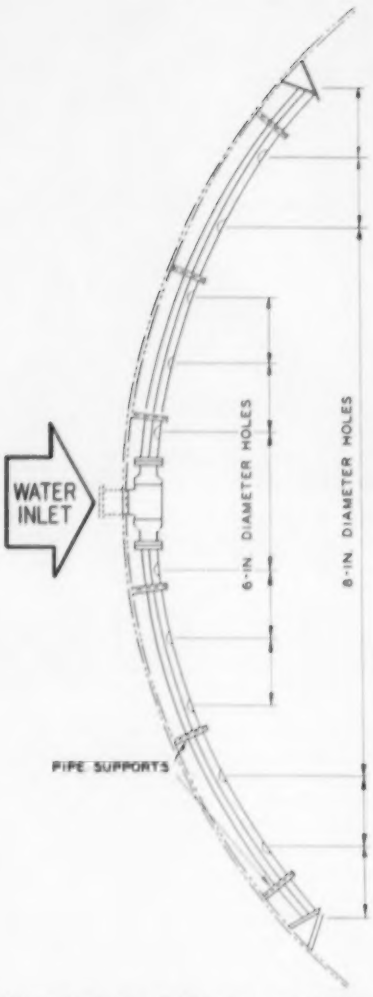
Sludge is allowed to accumulate in the bottom of the tanks until it must be removed. This was done after the first 4 months of operation. Then about 1,100 bbl. of sludge (50 per cent water) was evacuated by vacuum trucks.

Effluent from the preskimmers is picked up by two motor-driven centrifugal pumps or a standby steam-turbine-driven unit. En route to the two 25-bbl. dwell tanks, and water receives an injection of 40-psi. air. Baffles in the dwell tanks, as well as diffusers in the input line assures the maximum amount of air will be dissolved in the water.

Approximately 1 cu. ft. of air per 280 gal. of water is injected, producing a concentrated solution of air in water. Any entrained air causes turbulence and short circuiting in the flotation process. Thus excess air and vapors are removed through a relief



PLAN and elevation diagrams of Richfield's oil-recovery and waste-water-treating facilities. Fig. 1.



Above: To reduce turbulence in preskimming tanks, water enters tanks through two 16-ft. header sections. Fig. 2.

valve in the top of the tanks and pass into the vapor-recovery system.

Water enters at the bottom of the clari-flotators through a 12-in. line. Diffusers cause the water to flow laterally into the separating zone (Fig. 3).

The dissolved air is released from solution upon reduction of pressure to substantially atmospheric. The released air forms countless tiny bubbles which have sufficient velocity to carry particles of free oil and sludge to the surface.

As the air floats oil globules to the surface, four mechanical flight scrapers move the free oil to one of four hoppers. Speed of the rotating skim blades, driven by a ⅓-hp. electric motor and gears, is at the rate of one revolution each 12 minutes. Oil and sludge thus is skimmed from the surface every 3 minutes. A 6-in. line transports the oil to the triplex skimming pump, where it joins with that from the preskimmers and is pumped to storage.

A sludge scraper, also driven by the ⅓-hp. motor, slides along the inwardly sloping bottom and moves deposited sludge toward the center of the tank. There it drops into a small sump from which it is recycled to the preskimming tanks through a 4-in. line.

Air released in the tank, and any escaping hydrocarbon vapors are removed from the flotators through a 3-in. vapor-recovery line. Back-pressure valve controls operate to maintain a pressure of about ¼ psi. on the tanks. A recent analysis of the vapors recovered from the flotator showed the following composition:

	Mole per cent
Isobutane	0.44
n-Butane	0.18
Butenes	0.87
Isopentane	1.65
n-Pentane	0.82
Pentenes	1.57
C_6 plus	0.82
Oxygen	9.96
Nitrogen	83.65
Benzene	0.02
Toluene	0.02
H_2S	Nil
RSH	Nil

Clarified water leaving the separating compartment passes over a weir and drops into an effluent launder encircling the tank. From there it gravitates into a tile line which carries it to a gravimetric oil-water separator and thence to an outfall entering the Los Angeles Harbor.

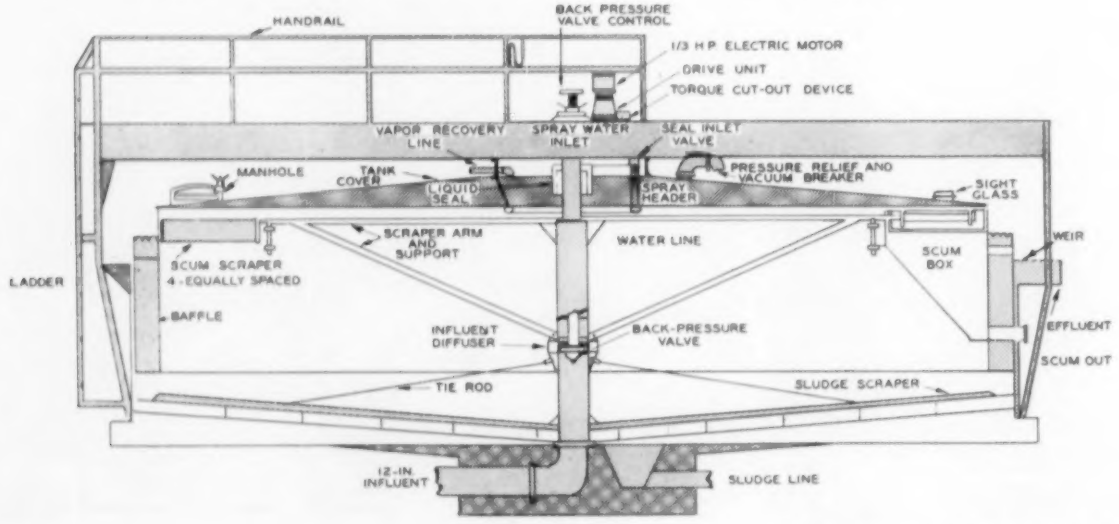
Samples of the clarified water are taken at 2-hour intervals and are saved for 60 days. These furnish a record of the composition of the water discharged into the Los Angeles disposal system. Likewise they show the amount of emulsified oil which was contained.

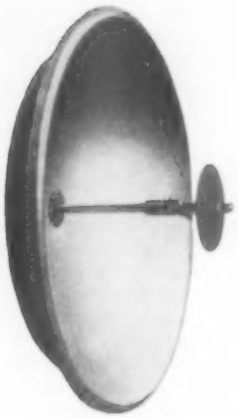
Only chemicals employed in the process are sulfuric acid and caustic for pH control. By means of a pH analyzer in the line to the preskimming tanks, pH of the incoming water is continuously indicated, as well as recorded in the control room. Through adding chemicals upstream from the plant, effort is made to hold the pH between 8 and 9. It is never permitted to go below 6.5 or exceed 10.

It has not been found necessary to use corrosion inhibitors. Constant checks of coupons has shown encouragingly little corrosion. When the tanks were inspected after the first 4 months of operation, a protective layer of oil was found to be adhering to the walls.

Sludge disposal remains a problem. Analyses have shown it to contain no recoverable oil. Comprised largely of asphaltenes and clayey solids, it has no commercial value. A partial solution is a planned addition of a dewatering tank which will cut by 50 per cent the amount of sludge which must be trucked out.

Below: Sectional view of flotator. Fig. 3.





How to plan a

Microwave Radio Relay System

How to select suitable sites, determine antenna heights and propagational reliability for both single and multihop systems; also selection of towers, buildings, and power accessories.

by D. R. Marsh

Part 1 of Two Parts

THE over-all performance of a microwave communic tions system is affected not only by the effectiveness of the microwave equipment itself, but also by the path over which it must be operated.

It is essential that the installation be carefully planned. It is in the initial planning stage that the user's communications engineering staff assumes a major role in determining requirements based upon local terrain conditions and sound microwave principles.

The microwave planning information contained in this article is an accumulation of many years' experience by RCA engineers in designing and installing microwave systems. By using this information, the engineer can determine what electrical and physical factors will influence the performance of his proposed systems.

He can determine what antenna heights will be necessary to give most reliable performance; and what antenna sizes should be used. And finally he can plan a tailored system.

Fundamentals of Microwave Propagation

Microwave energy is popularly assumed to travel from transmitter antenna to receiver antenna in a "beam" similar to that emitted by a searchlight. Actually, the situation is somewhat more complicated since amount of energy received is affected:

1. The proximity of the earth, which diffuses or scatters part of the energy from the beam and which may reduce the signal received, even though a "line-of-sight" path exists between the transmitting and receiving antennas.

Author is in communications systems engineering, Radio Corp. of America, Camden, N. J.

2. Reflections from the surface of the earth, which may arrive at the receiver in-phase or out-of-phase with the direct signal, thus reinforcing it or canceling it.

3. Variations in density of the earth's atmosphere, which cause the path of the beam to bend and which, under certain conditions, may cause fading.

4. Diffraction over or around obstructions.

5. Foilage, the density of which varies with the seasons, causing diffusion or scattering.

6. Open water or marsh land, which causes varying degrees of reflections.

For optimum results, it is necessary to plan the microwave system so that these effects will be minimized.

Fresnel zone . . . To minimize loss of signal due to absorption by the earth, it is necessary to provide more than "line-of-sight" clearance. A significant amount of the received energy, in effect, traverses other than a straight-line path. The region in which most of the useful energy is concentrated is called the Fresnel zone (Fig. 1.).

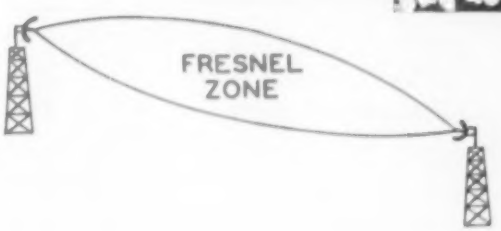
In theory, this region should be free of all obstructions. In practice, it has been found desirable to provide greater clearances for longer paths, while smaller clearances may be used for the shorter ones. Recommended clearances are given in the section devoted to antenna heights.

Owing to the extremely short wave length of microwave radiation, the surface of the earth is ordinarily a poor microwave reflector. Furthermore, such reflected energy usually is scattered diffusely so that very little of it reaches the receiving antenna. Occasionally, however, the nature of the terrain will be such as to produce a strong reflected signal. This occurs on overwater paths or when the terrain is smooth, conducting and free of vegetation (certain desert areas).

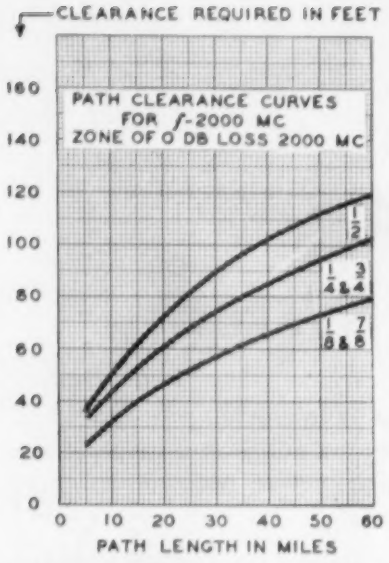
Fading . . . Terrain producing strong reflected signals is always undesirable and should be avoided whenever possible. When the path-length difference between the direct and reflected waves is such that the two arrive out of phase, cancelation occurs and will produce a deep fade.

Since the path-length difference may be changing constantly due to changes in atmospheric conditions, such paths are usually subject to severe fading. Special techniques such as high - low siting, which is discussed later, have been developed to avoid these effects.

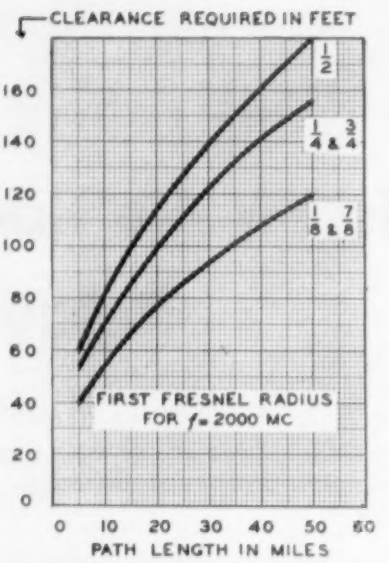
If the atmosphere were perfectly homogeneous, energy from the transmitting antenna would travel in a straight line to the receiver. Due to variations in density, however, the path



FRESNEL ZONE is the region in which most of the useful microwave energy is concentrated. Fig. 1.



PATH CLEARANCE CURVES, showing clearance values over a series of path lengths. Curves show clearances at the ½ point, ¼ and ¾ points, and ⅛ and ⅞ points. Fig. 2.



FIRST FRESNEL RADIUS CURVES for various path lengths. Fig. 3.

of the energy is refracted or bent. This can result in fading of the whole signal for a number of reasons, for example:

1. The whole Fresnel zone may, in effect, be sent downward in the middle of the path so that energy is diffused or scattered away from the beam.

2. The beam may be bent so far upward that it misses the receiving antenna entirely.

3. Multipath transmission may occur within the diffracting medium due to sudden changes in density of adjacent layers.

Nearly all paths are subject to some fading from atmospheric effects. Therefore, it is customary to make a fading allowance when planning microwave systems. In most parts of the country a standard fading allowance can be used with reasonable accuracy and will therefore be assumed.

In a few regions, particularly those which are subject to frequent periods of humid or stagnant air where wind velocities are less than 5 m.p.h., more severe fading can be expected. The presence of ground fog, in particular, is often an indication of fading conditions.

The most prevalent fading regions are found in the tropical and subtropical zones. It is desirable to make a special engineering analysis of any proposed paths in such areas.

Use of This Planning Guide

In planning a microwave relay link the engineer must determine fundamentally these questions:

1. What are the electrical and physical factors which will limit system performance?

2. What antenna heights should be used?

3. What antenna sizes should be used?

4. If unusual propagation or antenna-siting conditions exist, what special steps should be taken to insure satisfactory operation?

(Problems of this nature should be referred to competent authorities).

This guide will permit the user to determine the answer to the first three of these questions except when unusual conditions exist. It can be said that unusual conditions exist:

1. Where it is impossible to provide sufficient antenna height to maintain the path clearance indicated in Fig. 2.

2. Where the path is over water or over smooth terrain which might produce strong reflections. The terrain may be considered smooth if variations in height all along the path are less than 75 per cent of the first Fresnel zone radius computed at the center of the path. (See Fig. 3.)

3. Where the path length is greater than 10 miles and atmospheric conditions are conducive to usually severe fading.

Site selection . . . Sites for microwave stations should always be chosen to provide adequate line-of-sight transmission paths if reliable operation is to be insured. At the same time, attention must be given to the system requirements and to operational convenience. System requirements will be more fully considered in the section on multihop systems.

As a first approximation, sites should be selected which are not more than approximately 30 miles apart, unless the topography of the intervening terrain is such that adequate clearances over a longer path may be obtained. Potential sites should be located on a topographic map of the district.

A topographic map is a graphic representation of the configuration or shape of a portion of the earth's surface. If more than three stations are to be used in the system, the methods outlined in the section on multihop systems should be strictly observed.

If the sites selected satisfy these requirements, their merits should be evaluated from an operational standpoint. Preferably, the sites should be level and accessible to vehicles and a commercial power line should be within reasonable distance. Power regulation should be inherent or otherwise provided by automatic devices.

Path survey . . . Having made preliminary site selections, the terrain over which the path passes should be analyzed. Where maps are available and are of known accuracy, they may be used for this purpose; otherwise, a rough physical survey of the path must be made. During this survey, a note should be made of the height of any prominent obstacles, either natural or manmade.

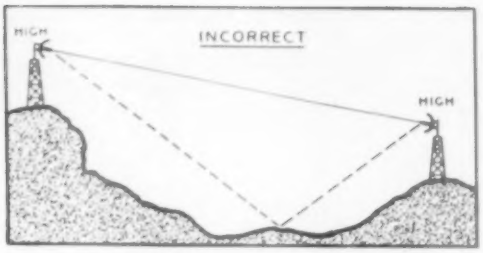
The general characteristics of the terrain, such as density of foilage, large bodies of water, swampy areas, rocky or sandy soil, should be noted. A physical inspection of the sites should always be made before attempting to erect stations at locations chosen by map or aerial-survey information.

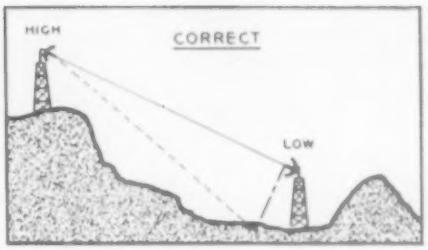
Antenna height . . . The first step in the calculation of transmitting and receiving antenna heights is to obtain an accurate profile of the ground level along the transmission path. This can be done by a number of methods. Where accurate topographic maps are available, they provide a simple and satisfactory means of obtaining the terrain profiles.

A bulletin entitled "Topographic Maps," as well as maps for specific areas may be obtained from the United States Geological Survey, Washington 25, D. C., or Denver 15, for maps of areas west of the Mississippi.

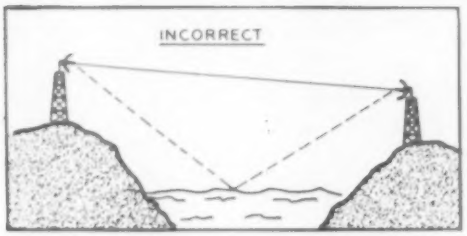
Where accurate maps are not available, a physical survey of the path should be made. This can be done with accurate calibrated sensitive altimeters which are properly adjusted in accordance with the barometric pressure and referred to a know point or bench mark.

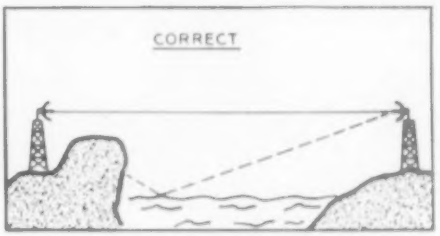
This is known as the American Paulin system. A line joining the two sites is drawn on a county highway



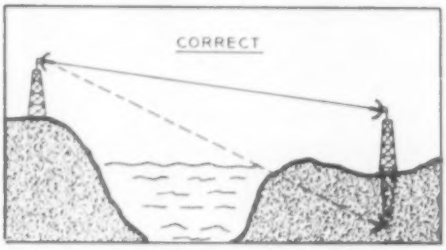


SITING OF STATIONS over smooth terrain. Fig. 4.





SITING OF STATIONS over water. Fig. 5.



CORRECT SITING for a part water, part land path. Fig. 6.

TABLE I

Path length	Nature of terrain	Weather	Multiply path clearance, Fig. 2, by
Up to 18M			1.0
18 to 28M	Broken	Normal air turbulence	1.0
18 to 28M	Smooth	Normal air turbulence	1.25
29 to 40M	Broken	Normal air turbulence	1.25
29 to 40M	Smooth	Normal air turbulence	2.0
18 to 28M	Broken	Ground fog prevalent	1.25
18 to 28M	Smooth	Ground fog prevalent	1.5
29 to 40M	Broken	Ground fog prevalent	1.75
29 to 40M	Smooth	Ground fog prevalent	2.25

map and the altitude measured at each point where the line crosses a road. Elevations between roads can be estimated but critical obstructions should be measured exactly.

More elaborate methods of surveying may be used including conventional civil-engineering techniques or the use of an aircraft-mounted absolute altimeter. However, their expense makes the use of a simpler system desirable whenever possible.

The importance of a sufficiently accurate survey cannot be overemphasized and judgment must be exercised to insure that adequate data are obtained.

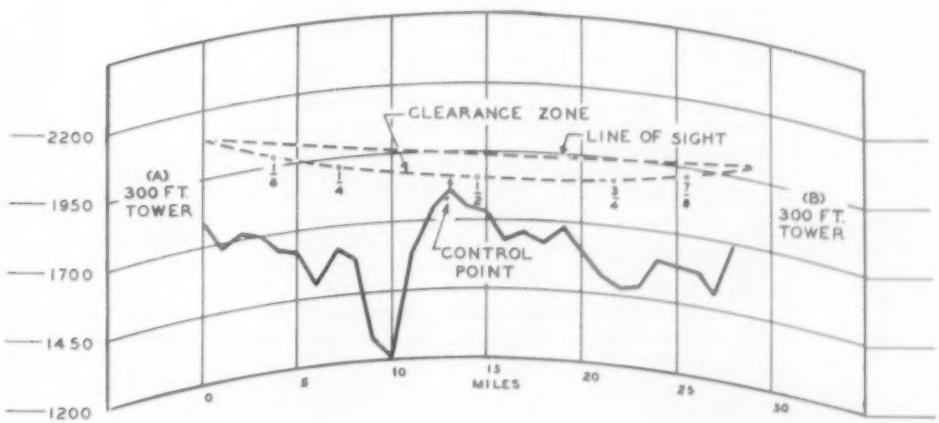
Multipath Signals

Attention should at this time be given to the possibility of multipath signals caused by reflections from the earth's surface. Such reflections are negligible when operating over irregular terrain such as encountered in rolling countryside. They become increasingly objectionable over smooth terrain.

If the use of paths over smooth terrain is unavoidable, the expedient of high-low station siting should be used when clearances permit. This condition is illustrated in Fig. 4.

In Fig. 4, left, the path of the reflected signal is appreciably longer than the direct path and the reflected signal is therefore subject to greater variations relative to the direct signal.

Fig. 4, right, shows that paths of the direct and the reflected signals are geometrically more equal in length. Since the point of reflection is near the low end, the signals are subjected to essentially the same propagation conditions. In may instances, the use of this technique will necessitate an ad-



TYPICAL MICROWAVE PATH, drawn on profile paper. Fig. 7.

ditional repeater station. An economic evaluation may indicate it expedient to find an alternate transmission path.

Overwater paths . . . Overwater paths should be avoided if at all possible. When such paths must be used, high-low siting of stations may prove useful. Another technique which is sometimes useful is to take advantage of the natural screening provided by terrain obstructions or by buildings.

Using an obstruction to reduce the reflected signal requires careful analysis, since the angle of approach of the reflected and direct rays is very small. This is not too apparent on the distorted scales used in preparing path profiles.

In case the path length is short enough to assume very little beam bending, the direct-ray obstruction loss will be negligible. However, as the distance increases, this loss will become more significant due to the greater diffraction medium. This results in a lower net gain, but fading stability can be improved. Fig. 5 shows a typical instance in which protection is available.

Circuits working over a path which is part land and part water should have station sites so located that the multipath point of reflection is located on the land portion of the path and as near to one station site as possible. (Fig. 6.)

The multipath point of reflection can be determined with reasonable accuracy by extending the beam to the image of the antenna and noting the point where it enters the earth's surface.

Path Clearance Requirements

As a final consideration before drawing the clearance zone on the path profile, an assessment should be made of the prevailing weather conditions over the various routes in the system.

According to the anticipated weather and general features of the terrain, the values for the clearances, as obtained from Fig. 2, should be multiplied by a factor which can be obtained from the tabulation given in Table 1.

As a general guide, it may be assumed that the terrain which the microwave path crosses is "broken" if the variations in profile height all along the path are greater than 75 per cent of the first Fresnel zone radius computed at the center of the path. (Refer to Fig. 3.)

In broken terrain, ground reflections will not cause excessive interference with the direct signal provided that the profile irregularities are located at random intervals along the path.

Having determined the required correction factor for the path clearance ordinates, the corrected zone may be drawn on the path profile.

Path profile . . . The elevations, including the height of obstructions, should now be drawn on special 4/3 earth's-radius graph paper. Fig. 7 shows a typical microwave path drawn on profile paper. In the absence of more specific information, a fixed allowance of 50 ft. should be made in rural areas for trees, low buildings, and other obstructions when these are not known.

In urban or metropolitan areas, suitable allowance must be made for tall buildings. This can ordinarily be done by visual inspection.

When plotting elevations on this paper, note that only one vertical scale can be used with a given horizontal scale. Suitable pairs of values are shown at the bottom of the graph. Also note that the middle of the path should be located at the center of the graph.

At the end of each path, insert vertical lines to scale to represent the chosen antenna tower and join the tops of the lines with a straight line to represent the direct radio path. Divide this path into sections representing ⅛, ¼, ½, ¾ and ⅞ of its total length. At these points, measure at right angles distances representing the clearances appropriate to the path length.

At this point refer back to Fig. 2, and note that the graph shows the required clearances at this section points for paths of varying lengths. The path clearance zone may be drawn by completing the curve delineated by section clearance points as shown (Fig. 7).

(Part 2 of this article will be published in next week's Journal.)

No More Gas-Engine Overhauls?

THE annual overhaul of gas engines might be on the way out.

Low wear rates experienced with 14 different oils with a million cumulative hours indicate several years' operation is possible without a teardown. Engine cleanliness is the deciding factor.

Engine overhaul will be determined more by sticky rings, plugged ports, and retarded heat transfer than by worn parts. Moral: keep it clean and keep it running.

These conclusions, results of exhaustive tests, were given to the regional meeting of the Natural Gasoline Association of America in Shreveport by Ed Shannon, Humble Oil & Refining Co.

The plant operator should keep these points in mind, Shannon says:

. . . Naphthenic-base oils appear better than paraffinic for two and four-cycle engines.

In two-cycle engines a detergent naphthenic oil proved satisfactory in all respects. It reduced ring sticking and minimized port plugging. In four-cycle engines, the naphthenic oil showed superior crankcase cleanliness compared to straight paraffinic oil. It also remained in better condition and provided better upper-ring-zone cleanliness.

. . . Cotton-waste or cellulose-fiber packing is best for use with detergent oils. Activated fuller's earth removes both soluble and insoluble matter. It can reduce detergent level to 20 per cent of its original value.

. . . Sight-feed lubricators should be avoided. Reaction of detergents and other additives with sight lubricator feed is undesirable.

Mechanical bobbers are an economical solution. Recently developed vacuum type of sight-feed lubricator which completely eliminates need for a fluid has possibilities.

. . . Viscosity increase is an operating problem with four-cycle engine.

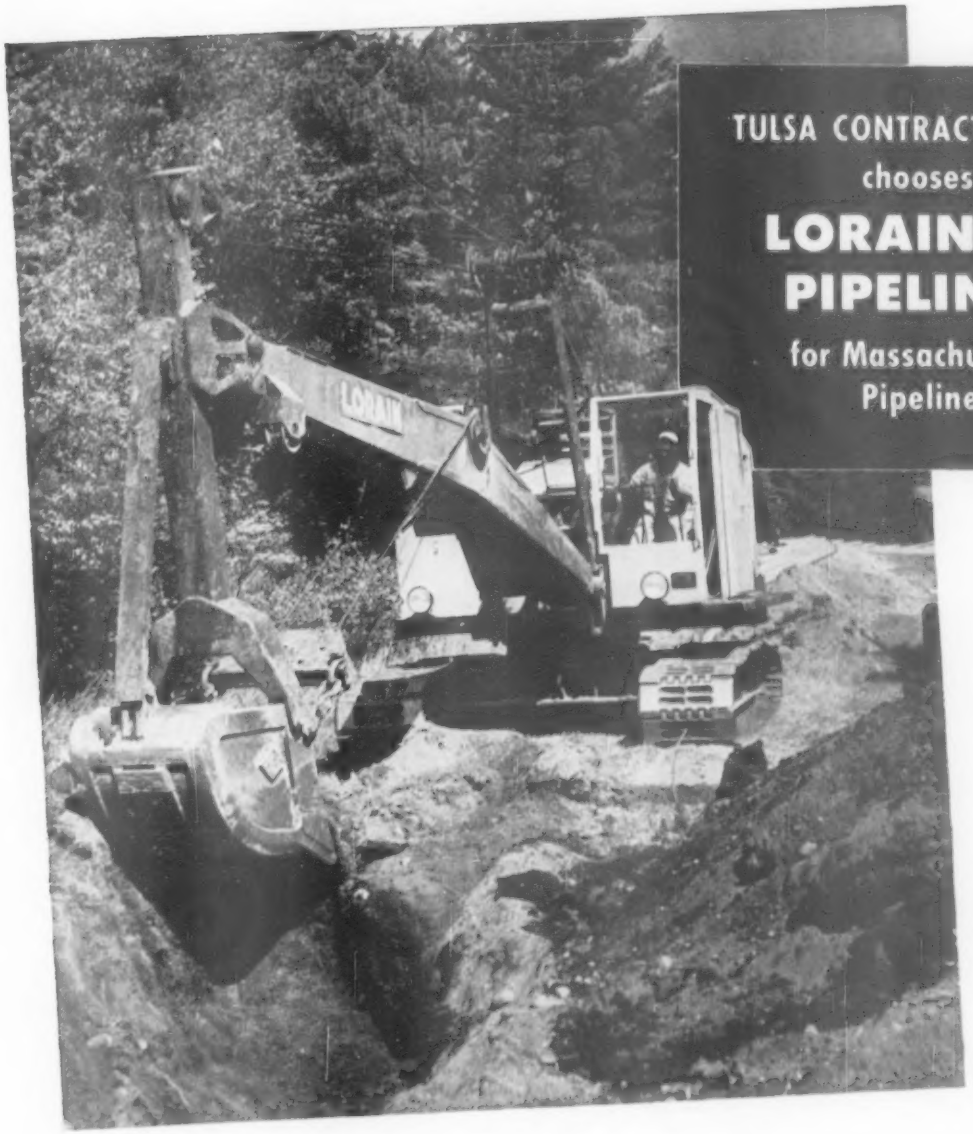
It seems to be aggravated by conformable type of rings. They control the consumption of oil so that very little makeup is required. This makes oxidation a more serious problem and results in viscosity increase sometimes up to 50 per cent. One solution is to pull oil out of the crankcase for use as a compressor cylinder lubricant. More makeup will then be required and the viscosity level can be better maintained.

. . . Overlubrication should be avoided.

In two-cycle engines, the most serious problem is port plugging. Humble's tests have proven that naphthenic oils are superior to paraffinic in this instance. However, Shannon notes, power-cylinder feed rate is also important.

It's not a case where if a little is good, more should be better. Instead, only the necessary amount of oil should be used for best performance. As a guide, feed rates in the order of 6,000 hp.-hr. per gallon of oil are desirable.

Economic data were based on current prices for detergent naphthenic oil and a six-element, waste-pack, partial-flow filter. In case A, filters were changed every 750 hours; oil, every 8,000 hours. Total cost: $602.50. In case B, both oil and filters were changed every 2,000 hours. Total cost $556. In case C, the crankcase was drained every 4,500 hours, filters changed every 1,500 hours. Total cost $484.



TULSA CONTRACTING CO. chooses LORAIN-26 PIPELINER for Massachusetts Pipeline

At its best, cross-country pipelining in New England is rough and rocky. For that kind of tough digging, Tulsa Contracting Co., East Providence, Rhode Island, put a Lorain-26 Pipeliner with 40" wide hoe dipper on a 12-mile natural gas pipeline job from Concord to Ayer, Mass. A 4-ft. deep, 3-ft. wide trench was dug through a good crop of boulders mixed with earth.

Lorain-26 Pipeliners have what it takes to "blast through the tough ones" . . . because the "26" Pipeliner is designed for that kind of duty. Lorain "E-Z" Controls, mounted throughout on anti-friction bearings, reduce operator effort and fatigue. Hydraulic Power Crawler Controls make it easy and fast to maneuver Pipeliner along the job. Independent travel, available as an extra, permits moving up on the job at will without interfering with other operations. Longer, 19-ft., stronger gooseneck boom gives maximum digging ranges . . . digs hardest materials. Larger, self-adjusting, 18" clutches make operation smoother, adjustments fewer and machine life longer. Sealed, anti-friction, bearing-mounted idler rollers reduce wear from mud and dirt. Bushed treads are available.

Get all the facts on the Lorain-26 Pipeliner. It has the features pipeline men want and need. Your Thew-Lorain Distributor has complete facts and figures for you!

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Finally, we "Satin Finish" the bore to further increase liner life.

To get *all* the life built into Mission Pistons and Mission Liners, however, they must be used together.

Mission Pistons, for example, will give outstanding service in any make of liner — but an oversize or excessively worn liner will shorten piston rubber life.

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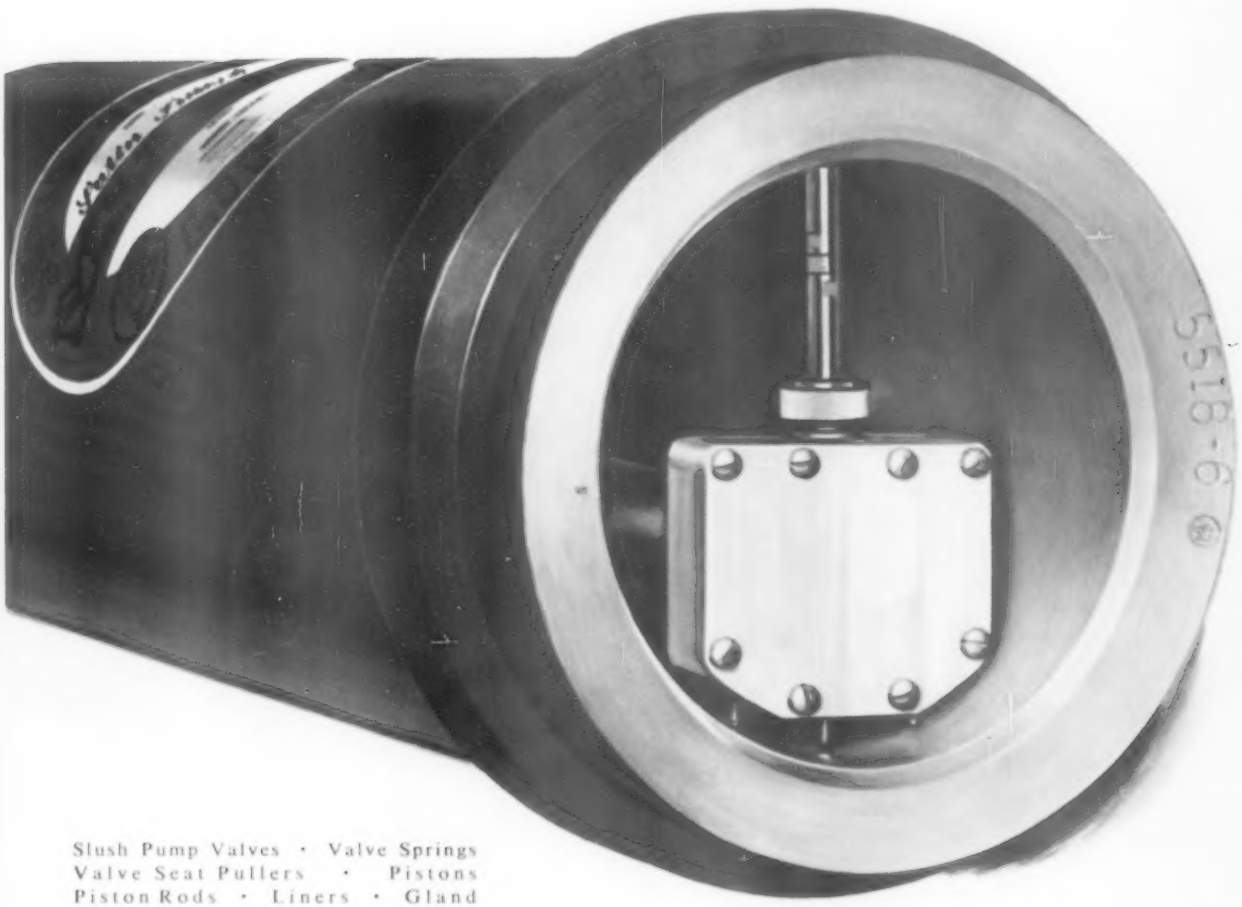

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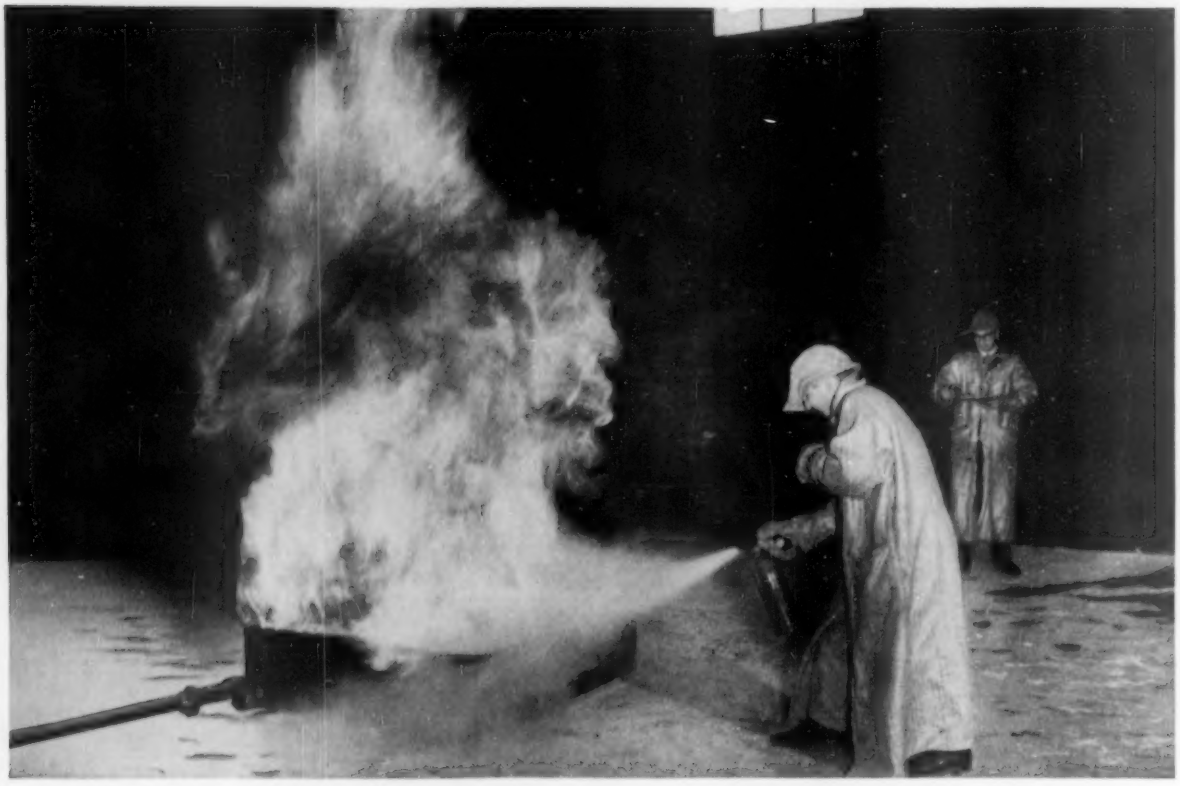

OPERATION POOF!

Kidde Dry Chemical Extinguishers prove fatal to oil fire in independent laboratory test!

An oil and gas mixture was set ablaze under actual test laboratory conditions. Using a Kidde 5-pound portable Dry Chemical Extinguisher, trained firefighters snuffed out the flame before it could spread!

Kidde spends years of research and thorough testing of all its dry chemical extinguishers to insure the greatest fire protection possible. Result: Kidde exclusives like the patented *diffuser horn* to give a wider coverage than ordinary dry chemical extinguishers...easier-maneuvering units...and *trigger-finger grips* for quicker, easier handling even in the hands of inexperienced operators.

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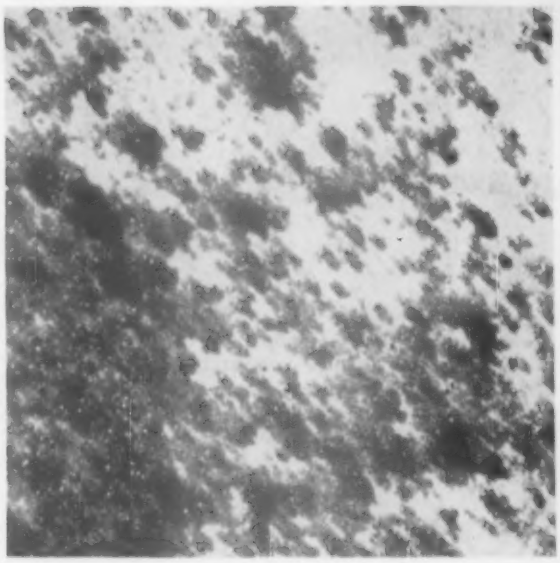


Two years of use with Microballoon sealing foam show vapor loss cut 50 to 80 per cent. Thus . . .

"Fluid Floating Roof" Lives Up to Promises

by W. A. Keutgen

SIGNIFICANT reductions in crude-oil evaporation loss have been reported by four companies using a Microballoon* sealing foam in cone-roof working tanks.

Evaluation made recently by American Oil Co., Cosden Petroleum Corp., Sinclair Refining Corp., and D-X Sunray Oil Co. show vapor loss has decreased 50 to 80 per cent in those tanks where a layer of Microballoon spheres was installed.

In three cases, the installations have been in operation for more than 2 years.

On August 17, 1954, Mid-Continent installed a ⅝-in. layer of Microballoon spheres on a test tank of the ordinary fixed-roof type. This tank was a 35,000-bbl. No. 230 working-storage tank, located on the company's pipeline. Crude is pumped through the tank from the line at the rate of 2,500,000 bbl. per year.

A mixture of select crude oil and mixed crude casing head is worked in this tank which is receiving and pumping 80 per cent of the time. The crude and gasoline mixtures pumped into the tank daily vary in ratio from 180 bbl. of casing-head gasoline and 6,000 bbl. of select crude, to 1,000 bbl. of gasoline to 1,000 bbl. of select crude.

Author is with development laboratories, Bakelite Co., Bloomfield, N. J.

*A registered trade-mark of Standard Oil Co. (Ohio).

Other factors . . . This ratio of crude to gasoline is only one of the many factors which influence the rate of evaporation from the tank. Other factors include the amount of vapor space in the tank (which varies as the level of the crude rises and falls), temperature (which ranges as high as 110° F.), and the diameter of the tank (which measures a little over 76 ft.).

Because of the varying ratio of gasoline to crude and the constant movement occurring in a tank so heavily worked, Mid-Continent has been unable to establish the exact saving affected since the cover was introduced 2 years ago. However, it is felt that the layer has saved about 70 to 80 per cent of the evaporation losses which would otherwise have occurred. With crude selling at $3.00 per barrel, the annual savings on this tank alone are considerable.

The balloons cost Mid-Continent $3,000 to install (versus about $20,000 to install a floating roof on the tank), and the installation required only a few hours (as opposed to the six months required to install a floating roof).

Adding foam . . . The foam layer was installed over a period of 3 hours by pouring the balloons through and 18-in. manhole in the cone roof of the tank. They spread over the surface of the crude within 24 hours, forming a blanket about ⅝ in. thick. Some compacting occurs due to working conditions, and after 2 years the layer is still about ½ in. thick.

Later investigation with the spheres has shown this method of installation to be capable of generating an electrostatic charge in the vapor space of the tank. For complete safety, the material must be pumped into the tank with the crude oil.

An aspirator, such as the one commonly employed to mix dry chemicals with water in foam fire-fighting systems, may be used for this purpose. Since Microballoon spheres are customarily shipped in paper bags, these can be dumped into a hopper mounted over the aspirator.

Oil is pumped through the aspirator and the mixture of oil and spheres is piped to the regular tank inlet. In addition to being a completely safe method of installation, pumping them in with the oil causes the balloons to spread out more quickly and evenly.

Under Control Conditions

More exact data, obtained under control conditions, on the effectiveness of the foam-layer cover is provided by the testing program of American Oil Co. This program consisted of metering and analyzing the vapor losses from two 65,000-bbl. cone-roof tanks while

PIPELINING

being worked with 8-10-lb. R.v.p. Kelly crude.

One tank contained a ½ to 1 in. layer of spheres and the other tank was uncovered. A 72 per cent reduction in hydrocarbon vapor loss was reported from the Microballoon-covered tank.

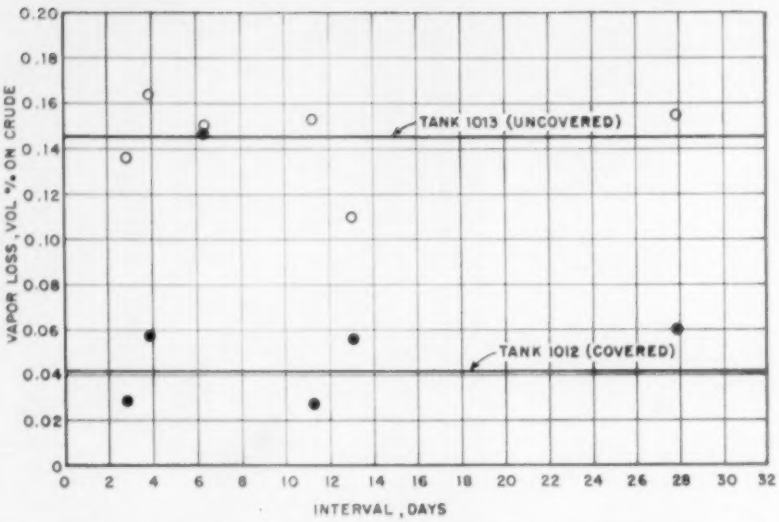
Preparation . . . The two tanks, which measured 114 ft., 6 in. in diameter by 35 ft. high, were first inspected, repaired, and painted to insure gas tightness. A series of probes was installed to permit sampling the liquid at various locations within the tank, together with instruments for recording temperatures, pressures, and oxygen content of the vapors.

With the exception of one conservation pressure-volume vent, all hatches and gages on the tank were sealed off. The pressure-volume pallets were removed from one vent, and by pumping water into the tanks and displacing air at a known rate, it was possible to calibrate the pressure drop across this vent in terms of vapor flow through it.

After these preparations were made, a series of preliminary tests were run to develop the best testing procedure and to compare the vapor loss from the two tanks on an equal basis.

Working time interval . . . The first series of tests conducted was concerned with the effect on vapor losses of the time interval between working the tanks. This interval was defined as the period between the time the tank is pumped down to a level of 12 ft. and the time when oil is pumped into the tank again. Tests were run at intervals of from 3 to 28 days with a pumping rate of 3,200 bbl. per hour.

The results of these tests are illustrated in Fig. 1. In this illustration vapor loss is expressed as a per cent of the crude pumped into the tank. It can be seen that the vapor loss from the sphere-covered tank varied from .027-.06 per cent volume of throughput, ignoring the test for a six-day interval between pumpings. The loss from the control tank varied from .110-.164 per cent. The intervals between pumpings had no appreciable affect on the vapor loss from either tank. The average loss from the tank covered with Microballoon spheres is about .041 per cent. The average loss from the control tank is .145 per cent. Based on these values, the efficiency of the "Microballoon" layer in reducing vapor loss is 72 per cent.



HYDROCARBON-VAPOR LOSS during filling at various intervals between pumpings. Fig. 1.

Low Payout Time

Results similar to those received by Mid-Continent and American Oil were also obtained by Sinclair Refining Corp. and Cosden Petroleum Corp. on their installations. After comparing the vapor loss from an 80,000-bbl. working tank using a ½-in. layer of the spheres with an uncovered tank, Sinclair concluded that vapor loss had been effectively reduced in the covered tank.

Sinclair's balloon layer was installed very early in 1954 at its Houston location and has been in continuous operation since that time. The Reid vapor pressure of the crude worked during these tests was 5.6 psi. in the Microballoon tank and 4.9 psi. in the control tank. The tanks discharged oil at the rate of 2,000 bbls. per hour and were turned over an average of five times a month.

Since the readings taken from the tanks were concerned only with vapor lost during filling operations, a comparison of the breathing loss—nearly equal the filling loss, according to the A.P.I. symposium report—would appreciably increase the saving.

As a result of its testing experience, Sinclair is extending use of the product to its older cone-roof tanks at this location, which cannot profitably be converted to any other type of evaporation control because of their age.

Cosden experience . . . Cosden Petroleum Corp. is effecting at least a 75 per cent reduction in vapor loss effected by balloon layers on two 80,000-bbl. working tanks. Used as feed tanks to refinery units, the tanks are worked continuously at the rate of 260 bbl. per hour and are turned over once every 5 or 6 days. About 1,500,000 bbl. of high-gravity sweet crude with a gravity of 37° to 45° A.P.I. is pumped through each tank annually.

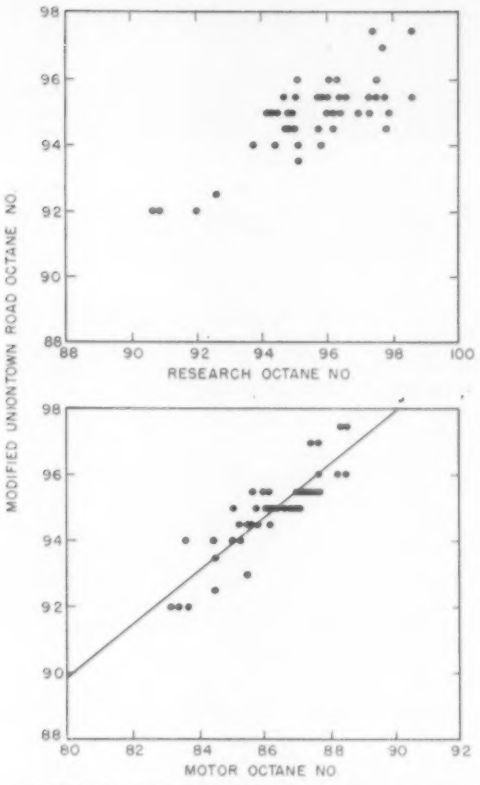
One of Cosden's two Microballoon tanks is equipped with a jet mixer to prevent the building up of b.s. and w. on the tank bottom. When the thickness of the balloon layer was measured recently, the layer in this tank appeared slightly thinner than the layer on the tank without a mixer. Although this apparent thinning out could be the result of several factors, such as the packing effect of the balloons, it is possible that at some time during pumping out the tank, too low an oil level occurred. This could have caused a vortex formation that sucked out some of the foam material.

Operating Conditions

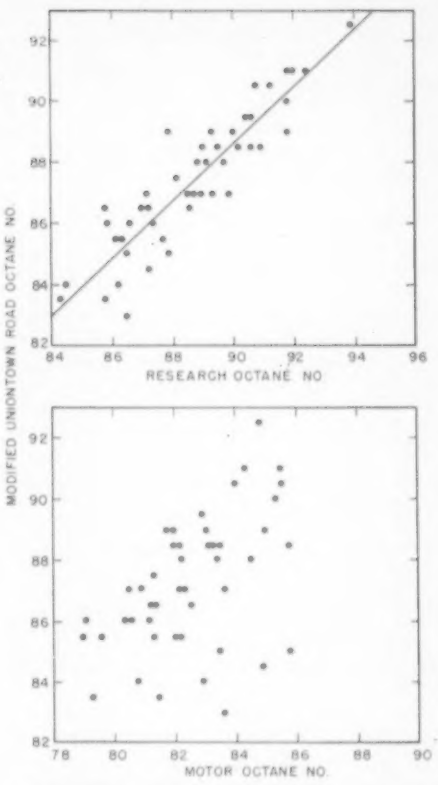
Cosden's experience points up the importance of establishing proper shutoff points to prevent the spheres from being pumped out of the tank. A number of measurements have been made of vortex heights during pumping operations at different outlet velocities. These showed the vortex heights in tanks containing ½ in. of foam were less than one-sixth as high as those in uncovered tanks.

Therefore, no appreciable rise in shutoff points should be needed for tanks being worked with a balloon covering. In tanks equipped with swing lines, the shutoff point should be set above the swing-line height.

Mixers can be run intermittently without disturbing the foam or allowing b.s. and w. to settle out. Mid-Continent Pipe Line Co. ran the mixer in its tank 15 minutes at a time and then stopped for 90 minutes. This unit was run only while pumping out of the tank and was stopped when the crude level reached 12 ft. or lower. The proper level at which to stop the mixer depends on many factors and must be determined experimentally at each installation.



OCTANE-NUMBER TESTS, road and laboratory results for 1956 test car, make J. Fig. 1.



OCTANE-NUMBER TEST RESULTS for 1955 test car, make M. Fig. 2.

Effect of Gasoline Sensitivity on Road Octane Number

by William E. Morris

FOR fuels having the same research octane number, sensitivity (research minus motor octane number) has little or no effect on road octane rating in cars that give road ratings which correlate with research octane number.

However, increased sensitivity gives lower road octane numbers in those cars that give road ratings which correlate with motor octane number.

Therefore, on an over-all basis, gasolines with a low sensitivity are superior in road performance to gasolines with a high sensitivity, when both gasolines have the same research octane number.

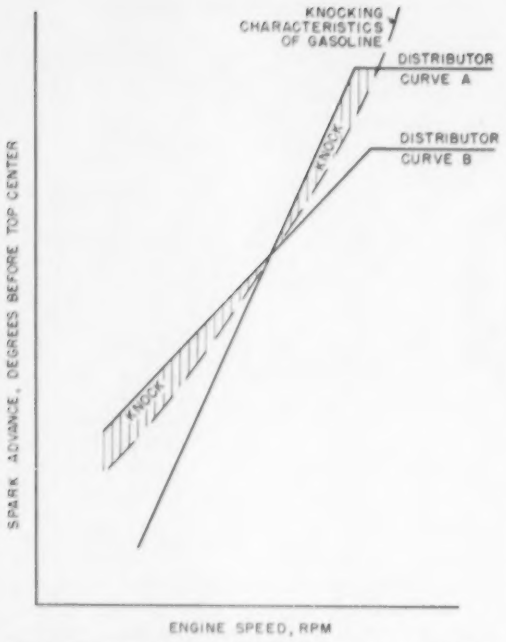
Octane relationship . . . Sensitivity taken alone has no relationship with road octane number. For example, Gasoline A and Gasoline B each have a sensitivity of 10 but Gasoline B would unquestionably be superior on the road.

	Gasoline	
	A	B
Research octane number	90	100
Motor octane number	80	90
Sensitivity	10	10

The important consideration is the effect of the sensitivity **at a given research octane number** on Modified Uniontown road octane number. In the Modified Uniontown technique, spark setting is adjusted until trace knock occurs during some portion of a wide-open-throttle acceleration. The speed at which the knock occurs is recorded but does not affect the road octane number. The octane number is determined by comparing the spark setting for trace knock on the test fuel with spark settings at which trace knock occurs on reference fuels of known octane number. Modified Uniontown road octane number may be considered a direct measure of customer acceptance of gasolines.

Road effects . . . Sensitivity can have a very large or a very small effect on road octane number depending upon the cars and fuels used. For example, as shown in Fig. 1 the Modified Uniontown rating of 50 premium gasolines obtained in a 1956 car of make J correlated with motor octane number although the level of the octane numbers obtained on the road were closer to the research than to the motor octane numbers.

A 98-research-octane-number gasoline could have a road rating in the range of 95 to 98. If a 98-octane gasoline had a sensitivity of 9, which means



DISTRIBUTOR CHARACTERISTICS affect speed of knock. Fig. 3.

a motor octane number of 89, its road rating would fall between 97 and 98. If a 98-octane gasoline had a sensitivity of 12, which means a motor octane number of 86, its road rating would be approximately 95.

Thus for car J the lower-sensitivity gasoline would be superior. On the other hand, road ratings of 48 regular gasolines in a 1955 car of make M correlated with research octane number but had little relationship to motor octane number as shown in Fig. 2. Thus in car M sensitivity does not affect road octane number.

Knock speed . . . Why is Modified Uniontown road octane number related to research octane number for some cars and motor octane number for others? The most important factor determining the relationship of road to laboratory octane numbers is the speed at which knock occurs. If a car knocks at low speed the road octane number generally correlates with research octane number, but if a car knocks at high speed the road octane number generally correlates with motor octane number.

The speed at which knock occurs depends upon the characteristics of the engine such as carburetion, volumetric efficiency, and distributor characteristics as well as the characteristics of the transmission used in the car. For example, an engine having distributor curve A and using a fuel having the knocking characteristics shown in Fig. 3 would knock at high speeds.

However, the distributor characteristics can be modified to give curve B. This causes knock to occur at low speed. Setting the distributor specifications involves a compromise between knock and power—curve B would give less power at high speed and more power at low speed than curve A.

The transmission characteristics can also determine the speed at which knock occurs. For example, a car having distributor B, as shown in Fig. 3, would not knock in the very-low-engine-speed range when the car is equipped with a torque converter since this transmission does not allow low-speed operation of the engine under wide-open-throttle conditions.

High-speed knock . . . Why do road octane ratings in which knock occurs at high speed correlate with motor rather than research octane number? The answer lies in the differences in response of gasoline to engine operating conditions which are illustrated in Fig. 4.

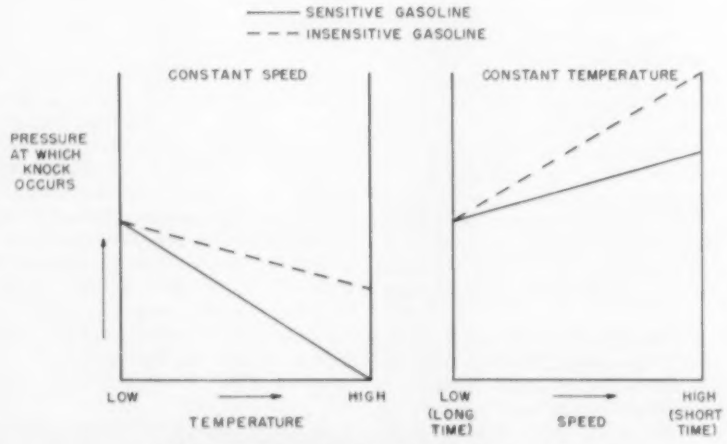
At constant speed, as temperature is increased knock will occur at lower and lower pressure, and sensitive gasoline becomes poorer relative to insensitive gasoline. At constant temperature as speed is increased higher pressures can be tolerated but the sensitive gasoline becomes poorer relative to insensitive gasoline. Thus, at high temperature and high speed, sensitive gasolines are penalized relative to insensitive gasolines.

Both types of gasoline are penalized relative to reference fuel which has a sensitivity of zero. High temperature and high speed both contribute to the decrease in octane number of commercial gasolines, and particularly the more sensitive gasolines, when going from research to motor method test conditions.

OPERATING CONDITIONS OF LABORATORY METHODS

	Research	Motor
Engine speed, r.p.m.	600	900
Intake air, °F.	125	
Intake mixture, °F.	About 100	300

Motor octane test conditions are unfavorable for the sensitive gasolines, and automobile-engine test conditions are also unfavorable toward sensitive gasolines when knock occurs at high speed, because of the relationships shown in Fig. 4. Thus, the relative knock resistance of gasolines in cars that knock at high speed is similar to the relative knock resistances determined by the motor method.



TEMPERATURE AND SPEED affect knock. Fig. 4.

THE AUTHOR

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ELEMENTS OF FIELD PROCESSING—22

TEMPERATURE CONTROL—2

by Dr. John M. Campbell

IT is often desirable to locate the burner away from the heat-transfer equipment. Such an installation is more expensive than the use of indirect heaters but may often be justified from considerations of safety and flexibility. The primary use is therefore in tank heaters, treaters, and stabilizers where these features are desirable.

Where the temperatures needed are not above 180° to 190° F. the 15-psig. steam generator is an efficient and flexible source of heat. The use of steam on the lease at pressures higher than 15 psig. is limited by present statutes and boiler codes which prohibit such vessels without continuous supervision.

The typical steam generator is gas-fired and has a thermostat and pressurestat as primary temperature controls. The thermostat is used as the primary control with the latter shutting off the burner supply gas if the pressure gets too high. A self-operated level-control valve is used for water makeup if such is available in the field. Because of the low water loss from the closed system a manual makeup is often used. The condensate normally flows back to the steam generator from the heat-transfer coil by gravity and no control is necessary.

Steam controller . . . The heating system shown in Part A of Fig. 1 is simple and transfers a large amount of heat per unit area of coil surface. In most field applications it is difficult to use a simple self-actuated temperature controller that has at least a 10 per cent proportional band. The valve may be located in either position (1) or (2) as shown.

Position (1) is preferred, for it requires a smaller valve and will usually give slightly more accurate control. In this position the temperature in the vessel is controlled by the height of condensate in the coil, i.e., changing the area available for transfering heat to the vessel. For example, if the temperature is too low the valve opens wider to drop the level and expose more area. In the event that the heating element is a low coil, position (2) would be necessary.

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Hot liquid . . . A typical hot-liquid circulation system is shown in Part B. The heater may be of any type but it is often a low-pressure modified steam generator. In this service it preferably has two thermostats, one for control and one as a high-temperature shutdown. The working pressure is usually 40 psig.

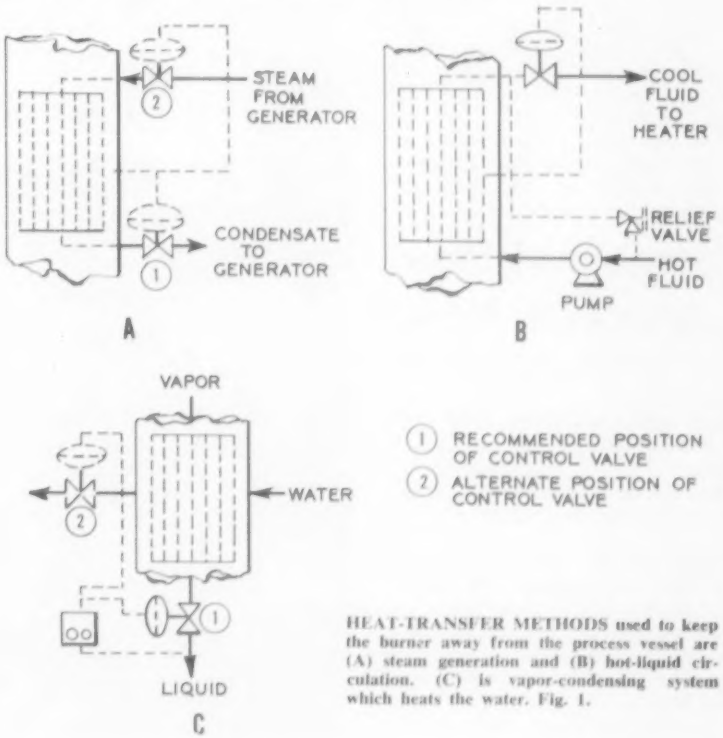
On the usual lease system hot water, circulated with a centrifugal pump, is used as the heating medium. For this service the control valve would be placed on the coil outlet. The bypass with the relief valve is not essential but often desirable when an open-impeller type of pump is used.

With a close-clearance centrifugal or positive-displacement pump the bypass is essential to keep from overpressuring the system if the control valve closes. When using the latter, the control valve may be placed on the bypass. The proper amount of fluid is then bypassed around the heater to maintain the proper temperature. The circulation rate should be such that this valve will be normally half open, affording temperature control in both directions. If the pressure drop across the heating coil is small the system shown in Part B is preferred, for a valve on the bypass would have to operate on too small a pressure differential.

Hot fluid may be circulated for services such as tank heating by means of thermo-syphon and gas jet action to eliminate the pump. The former makes use of the differential densities of hot and cold water and is not a very positive or flexible system of heating. The gas jet is more positive but finds decreasing application because of the increasing value of gas. Very few such systems are still seen, for tank heaters have been largely supplanted by compact treaters and heater-treaters.

Condenser . . . Part C shows two accepted modifications on a system where a vapor is being condensed, using cold water. The amount of heat transferred may be fixed by controlling the amount of water circulated or by fixing the flow rate and varying the heat transfer surface available. Where the heating coil has sufficient height, the latter method is preferred. The water rate may then be controlled manually.

In most oil-field applications there is no significant difference in the two methods. When using stacked finned-tube heat exchangers the valve must be placed in position (2).



HEAT-TRANSFER METHODS used to keep the burner away from the process vessel are (A) steam generation and (B) hot-liquid circulation. (C) is vapor-condensing system which heats the water. Fig. 1.

New tables show . . .

How to Check Octane Numbers Above 100

A SUGGESTED system of reference fuels with octane ratings of 100 to 120.3 (Weise scale) has been issued by American Society for Testing Materials. The octane scale, which is expected to be officially accepted next summer, is expressed in terms of isooctane and tetraethyl lead. It is defined in increments of 0.01 ml. of TEL per gallon, in the range from 1 to 4 ml. per gallon and in 0.1 ml. per gallon, in the range from 4 to 6 ml. per gallon.

Two conversion tables, Tables 1 and 2, will enable fuel-testing laboratories to convert from ml. TEL per gallon of isooctane, to octane number, or vice versa.

The tables are based on the following formula:

$$\text{Octane number (above 100)} = 100 + \frac{28.28T}{1+.736T+(1+1.472T-.035216T^2)^{1/2}}$$

Where:

T = ml. of TEL per U. S. gallon in isooctane.

Details of the changes required in A.S.T.M. motor method D 357 and A.S.T.M. research method D 908 have to be worked out. Anyone wishing to comment on the reference fuels is referred to W. T. Gunn, secretary of A.S.T.M. Committee D-2, Room 2040, 50 West Fiftieth Street, New York 20.

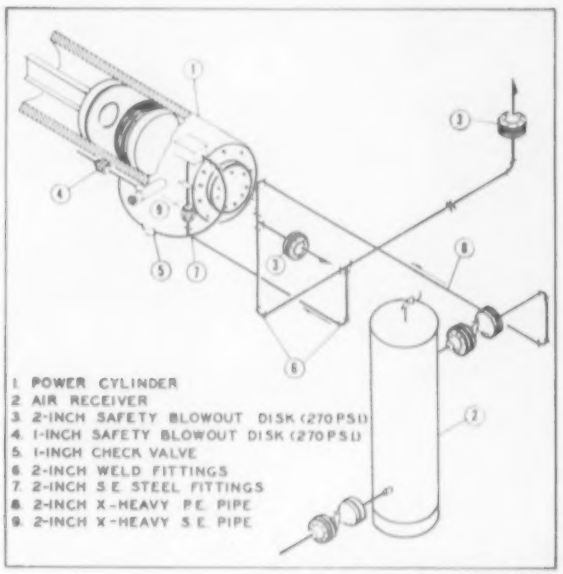
TABLE 1—CONVERSION OF ML. TEL PER U. S. GALLON IN ISOOCTANE TO OCTANE NUMBERS ABOVE 100

ml. TEL	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	100.0	100.1	100.3	100.4	100.5	100.7	100.8	100.9	101.1	101.2
0.1	101.3	101.4	101.6	101.7	101.8	101.9	102.0	102.1	102.3	102.4
0.2	102.5	102.6	102.7	102.8	102.9	103.0	103.1	103.2	103.3	103.4
0.3	103.5	103.6	103.7	103.8	103.9	104.0	104.1	104.2	104.3	104.3
0.4	104.4	104.5	104.6	104.7	104.8	104.9	104.9	105.0	105.1	105.2
0.5	105.3	105.4	105.4	105.5	105.6	105.7	105.7	105.8	105.9	106.0
0.6	106.0	106.1	106.2	106.3	106.3	106.4	106.5	106.5	106.6	106.7
0.7	106.7	106.8	106.9	106.9	107.0	107.1	107.1	107.2	107.3	107.3
0.8	107.4	107.5	107.5	107.6	107.6	107.7	107.8	107.8	107.9	108.0
0.9	108.0	108.1	108.1	108.2	108.2	108.3	108.4	108.4	108.5	108.5
1.0	108.6	108.6	108.7	108.7	108.8	108.8	108.9	109.0	109.0	109.1
1.1	109.1	109.2	109.2	109.3	109.3	109.4	109.4	109.5	109.5	109.6
1.2	109.6	109.7	109.7	109.8	109.8	109.8	109.9	109.9	110.0	110.0
1.3	110.1	110.1	110.2	110.2	110.3	110.3	110.4	110.4	110.4	110.5
1.4	110.5	110.6	110.6	110.7	110.7	110.7	110.8	110.8	110.9	110.9
1.5	111.0	111.0	111.0	111.1	111.1	111.2	111.2	111.2	111.3	111.3
1.6	111.4	111.4	111.4	111.5	111.5	111.5	111.6	111.6	111.7	111.7
1.7	111.7	111.8	111.8	111.9	111.9	111.9	112.0	112.0	112.0	112.1
1.8	112.1	112.1	112.2	112.2	112.2	112.3	112.3	112.4	112.4	112.4
1.9	112.5	112.5	112.5	112.6	112.6	112.6	112.7	112.7	112.7	112.8
2.0	112.8	112.8	112.9	112.9	112.9	113.0	113.0	113.0	113.0	113.1
2.1	113.1	113.1	113.2	113.2	113.2	113.3	113.3	113.3	113.4	113.4
2.2	113.4	113.4	113.5	113.5	113.5	113.6	113.6	113.6	113.7	113.7
2.3	113.7	113.7	113.8	113.8	113.8	113.9	113.9	113.9	113.9	114.0
2.4	114.0	114.0	114.1	114.1	114.1	114.1	114.2	114.2	114.2	114.3
2.5	114.3	114.3	114.3	114.4	114.4	114.4	114.4	114.5	114.5	114.5
2.6	114.5	114.6	114.6	114.6	114.6	114.7	114.7	114.7	114.7	114.8
2.7	114.8	114.8	114.9	114.9	114.9	114.9	114.9	115.0	115.0	115.0
2.8	115.0	115.1	115.1	115.1	115.1	115.2	115.2	115.2	115.2	115.3
2.9	115.3	115.3	115.3	115.4	115.4	115.4	115.4	115.5	115.5	115.5
3.0	115.5	115.5	115.6	115.6	115.6	115.6	115.7	115.7	115.7	115.7
3.1	115.7	115.8	115.8	115.8	115.8	115.9	115.9	115.9	115.9	115.9
3.2	116.0	116.0	116.0	116.0	116.1	116.1	116.1	116.1	116.1	116.2
3.3	116.2	116.2	116.2	116.2	116.3	116.3	116.3	116.3	116.3	116.4
3.4	116.4	116.4	116.4	116.4	116.5	116.5	116.5	116.5	116.5	116.6
3.5	116.6	116.6	116.6	116.6	116.7	116.7	116.7	116.7	116.7	116.8
3.6	116.8	116.8	116.8	116.8	116.9	116.9	116.9	116.9	116.9	117.0
3.7	117.0	117.0	117.0	117.0	117.0	117.1	117.1	117.1	117.1	117.1
3.8	117.2	117.2	117.2	117.2	117.2	117.2	117.3	117.3	117.3	117.3
3.9	117.3	117.4	117.4	117.4	117.4	117.4	117.4	117.5	117.5	117.5
4.0	117.5	117.5	117.5	117.6	117.6	117.6	117.6	117.6	117.7	117.7
ml. TEL	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0
Oct. No.	117.7	117.9	118.0	118.2	118.3	118.5	118.6	118.8	118.9	119.1
ml. TEL	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0
Oct. No.	119.2	119.3	119.5	119.6	119.7	119.9	120.0	120.1	120.2	120.3

TABLE 2—CONVERSION OF OCTANE NUMBERS ABOVE 100 TO ML. TEL PER U. S. GALLON IN ISOOCTANE

Oct. No.	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
100	0.00	0.01	0.01	0.02	0.03	0.04	0.04	0.05	0.06	0.07
101	0.07	0.08	0.09	0.10	0.11	0.11	0.12	0.13	0.14	0.15
102	0.16	0.17	0.18	0.18	0.19	0.20	0.21	0.22	0.23	0.24
103	0.25	0.26	0.27	0.28	0.29	0.30	0.31	0.32	0.33	0.34
104	0.35	0.36	0.37	0.39	0.40	0.41	0.42	0.43	0.44	0.45
105	0.47	0.48	0.49	0.50	0.52	0.53	0.54	0.55	0.57	0.58
106	0.59	0.61	0.62	0.64	0.65	0.66	0.68	0.69	0.71	0.72
107	0.74	0.75	0.77	0.78	0.80	0.82	0.83	0.85	0.86	0.88
108	0.90	0.92	0.93	0.95	0.97	0.99	1.00	1.02	1.04	1.06
109	1.08	1.10	1.12	1.14	1.16	1.18	1.20	1.22	1.24	1.26
110	1.28	1.30	1.33	1.35	1.37	1.39	1.42	1.44	1.46	1.49
111	1.51	1.54	1.56	1.59	1.61	1.64	1.66	1.69	1.72	1.74
112	1.77	1.80	1.83	1.86	1.88	1.91	1.94	1.97	2.00	2.03
113	2.06	2.10	2.13	2.16	2.19	2.23	2.26	2.29	2.33	2.36
114	2.40	2.44	2.47	2.51	2.55	2.58	2.62	2.66	2.70	2.74
115	2.78	2.82	2.86	2.90	2.95	2.99	3.03	3.08	3.12	3.17
116	3.22	3.26	3.31	3.36	3.41	3.46	3.51	3.56	3.61	3.66
117	3.72	3.77	3.82	3.88	3.94	3.99	4.05	4.11	4.17	4.23
118	4.29	4.35	4.41	4.48	4.54	4.61	4.67	4.74	4.81	4.88
119	4.95	5.02	5.09	5.17	5.24	5.32	5.40	5.47	5.55	5.63
120	5.71	5.80	5.88	6.00						

How to reduce air-line explosion dangers


1. POWER CYLINDER
2. AIR RECEIVER
3. 2-INCH SAFETY BLOWOUT DISK (270 PSI)
4. 1-INCH SAFETY BLOWOUT DISK (270 PSI)
5. 1-INCH CHECK VALVE
6. 2-INCH WELD FITTINGS
7. 2-INCH S.E. STEEL FITTINGS
8. 2-INCH X-HEAVY P.E. PIPE
9. 2-INCH X-HEAVY S.E. PIPE

SAFETY EQUIPMENT helps prevent fuel-gas explosion. Fig. 1.

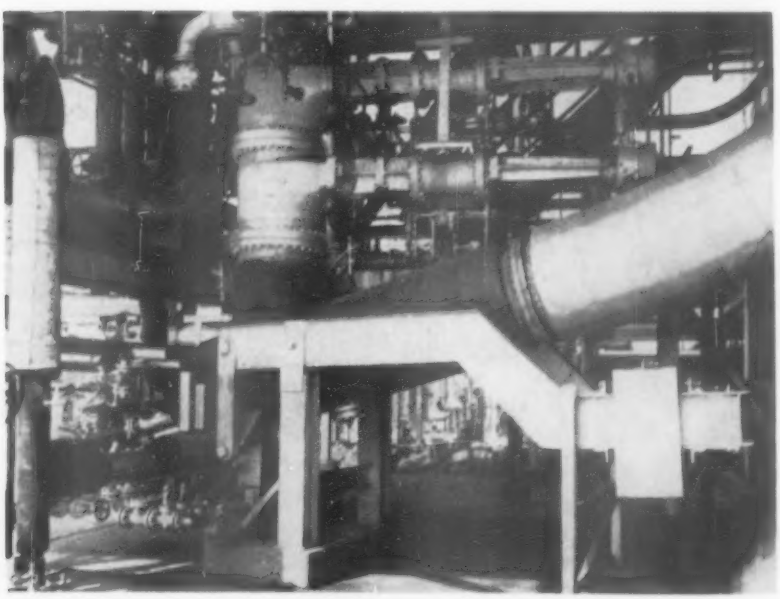
TO prevent danger of explosion of fuel gas which may leak back into the air starting line of engines, the following starting procedure has been adopted by one southwestern oil company:

1. Turn magneto switch to off position.
2. Bar flywheel over and make sure magneto will fire at least 10° after dead center with impulse retarded.
3. Spot flywheel to 35° past dead center.
4. Open starting air valve and allow flywheel to roll through six revolutions to sweep any unburned gas from combustion chamber.
5. Turn magneto switch to on position.
6. Open fuel valve partially and then to full open as engine picks up running speed.
7. When engine starts firing, close air starting valve.
8. If engine seems to stall at this point, adjust fuel valve; under no condition will the air valve be opened to give added momentum to the engine. Should the engine stop, go back and follow through the entire starting procedure.

Extra precautions . . . As an additional safety precaution the following equipment (see Fig. 1) is installed:

1. An air receiver tank is installed to increase the available starting air.
2. Two-inch safety blowout disks (rupture pressure, 270 psi.) are installed in each end of the air header, and a 1-in. safety blowout disk is installed in the air line between the check valve and the power cylinder.
3. The standard cast-iron fittings in the air line to each engine are replaced with steel fittings.

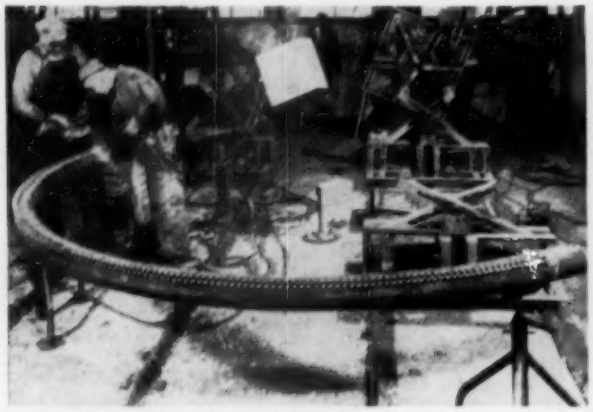
There have been several cases where the engine operator did not follow the starting procedure to the letter; but in each case, the exploded gases ruptured the blowout disk adjacent to the power cylinder and nothing was damaged.



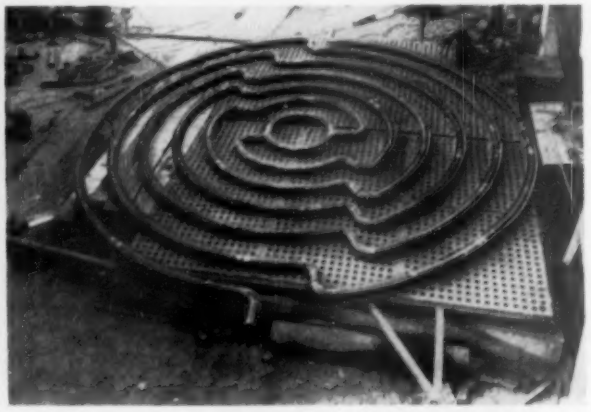
Counterbalanced lines are used for expansion and vibration control

ON main catalytic cracker charge lines, the line may be mounted as shown here.

The line sets in a cradle and is counterbalanced with expansion and vibration control in mind. This particular installation is at Carter Oil Co.'s, Billings, Mont., plant.



TWO-MAN CREW applies 2,000 end-welded studs per 8-hour day.



SERIES OF COILS is the end result. Tubing starts with a 5-ft. diameter inner circle.

End-welded studs eliminate all drilling, punching, and tapping

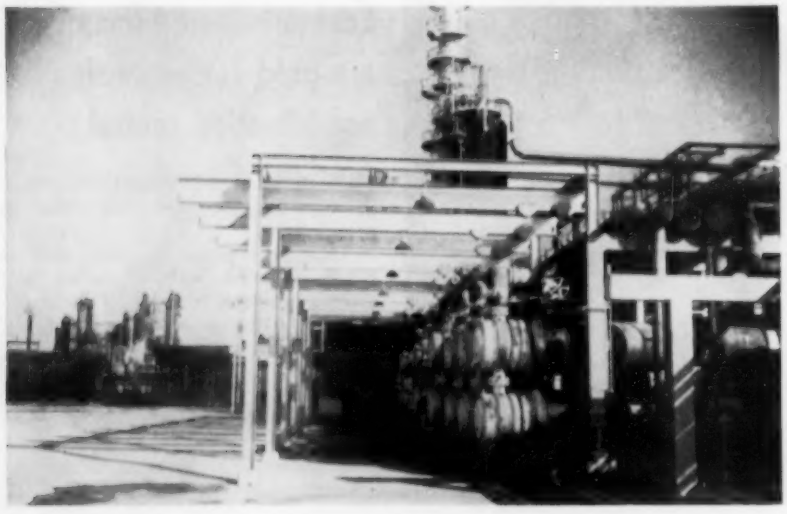
END-WELDED studs, applied by a two-man crew at the rate of 2,000 per 8-hour day, replaced conventional heat-transfer fins in a large recently fabricated cooling coil.

Nelson unthreaded studs, ½ in. in diameter and 1½ in. long, were end-welded on 1-in. centers in rows 90° apart around 4-in. tubing. The tubing starts with an inner circle 5 ft. in diameter and expands outward in a series of coils to a diameter of 32 ft. The job was a comparatively quick and easy one, in contrast to the slow and cumbersome hand welding that would have been required with fins.

Special heads . . . Several years ago Sun Oil Co.'s Toledo refinery first used another stud-welding development. Then Nelson stainless-steel studs with special heads 2 in. sq. were first used to hold insulation blocks and refractory tiles in place within a catalyst regenerator. This application reduced installation and maintenance costs and improved operation of the equipment.

End-welded studs are currently being employed on various refinery structures to secure Foamglas, rock wool, concrete anchors, reinforcing bars, corrugated steel or aluminum sheets, gunite, electrical conduit and piping, grating, and identification tags.

Besides its inherent speed, stud welding is particularly suitable for refinery fastening jobs because of its one-side application which eliminates all drilling, punching, and tapping. Where tanks and containers are involved, stud welding removes the necessity of sealing holes after fasteners have been applied.



Monorails used for heat-exchanger cleaning

THIS heat-exchanger battery is equipped with individual monorails and hoists to facilitate cleaning bundles. With the use of these monorails and hoists, mobile equipment can be run in for a quick cleaning job.

This is a catalytic cracking unit at Sinclair Oil & Gas Co.'s Houston refinery.

by W. L. Nelson
Technical Editor

QUESTIONS ON TECHNOLOGY

Effect of Gravity on Refinery Operating Costs

What is the effect of gravity on the costs of refinery operation? We are surprised to see in your Technical Questions of August 6, 1956, that it costs more to process a 48° A.P.I. crude oil than a 16° A.P.I. oil.—G. Wm. T.

Although large yields of gasoline can be obtained cheaply from a high-gravity crude oil, the gasoline usually has such a low octane number that the cost of tetraethyl lead or of upgrading by other processing means is greater than the cost of cracking the large amount of gas oil in a low-gravity crude oil. There are also many other factors, especially the larger sulfur content of low-gravity oils with its attendant corrosion costs.

Thus, the ideal type of crude oil is a naphthenic or intermediate oil that tends toward naphthenic properties which has an average or low gravity, and which contains relatively little sulfur. Such a crude oil yields relatively high-octane straightrun gasoline which when mixed with the almost equal amount of cracked

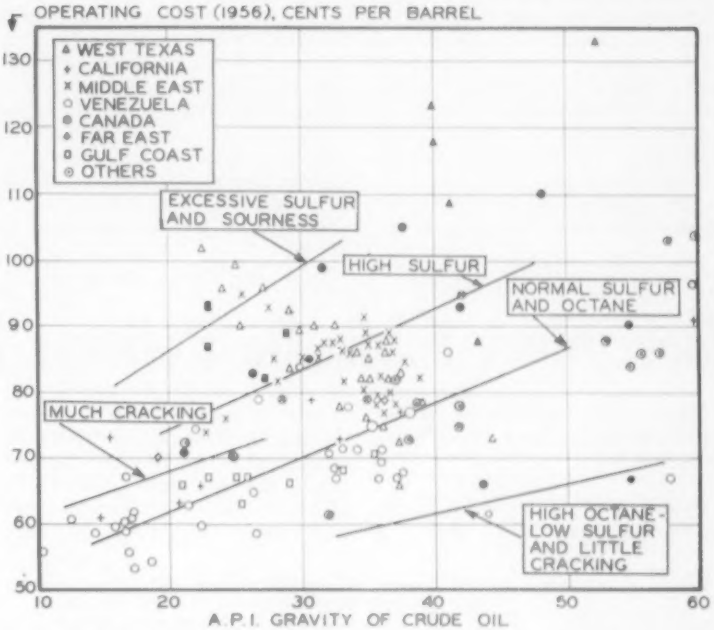


Fig. 1—Variations in refinery operating costs as a function of gravity, sulfur, sourness, octane number, and amount of cracking. Gulf Coast 30,000-bbl. refineries (1956). (Solid points indicate the production of lubricants or wax.)

TABLE 1—STANDARD REALIZATION METHOD* REFINERY OPERATING COSTS FOR A FEW TYPICAL OILS (GULF COAST 1956)

Crude oil—	Bachaquero, Venezuela	Hendrick, W. Texas	Middle East	Tia Juana 102	East Texas	Wax crude, Venezuela	Southern Oklahoma	Pennsylvania
Gravity °A.P.I.	16.4	29.7	31.6	25.8	38.5	41.8	32.0	43.9
Sulfur, per cent	2.02	1.49	2.52	1.65	0.33	0.2	0.82	0.1
Octane Number of straightrun gasoline	64	52	41.5	55	57	63	39	46
U.O.P. factor at 750° F.	11.2	11.5	11.8	11.6	12.0	12.2	11.9	12.45
Cracking stock, per cent	31.6	33.5	28.4	5	29.8	27.6	18.7	7.9
Yields, per cent:								
Unaccounted	2.4	3.0	3.5	0.9	3.2	3.0	1.6	1.5
Straightrun gasoline	7.8	25.3	27.7	20.2	33.2	40	25.5	35
Cracked and poly gasoline	18.6	20	17	2.8	18.3	17.1	11.2	4.7
Kerosine					13.6			12.7
Diesel fuel				25.5			30	
No. 2 distillate	10.8	15.9	13.2		5.1	15.5		4.8
No. 3 distillate	5.5	5.9	5.0	0.9	5.2	4.8	3.3	1.4
Wax						3.9		
Lube oil:								
Low cold test				10				
Paraffinic								30.2
Others					3.3			
Bunker C fuel	54.9	29.4	33.6	39.7	18.1	15.7	28.4	9.7
Costs, cents per barrel:								
Basic investment†	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
General labor†	8.5	13.3	12.6	11.4	15.5	15.9	13.7	17.2
Sulfur penalty	13.4	12.3	16.8	10.1			5.0	
Sourness penalty		6.1						
Fuel, power, and water†	7.9	12.4	11.6	10.5	14.3	14.8	12.6	15.8
Cracking	13.5	14.4	12.2	2.1	12.8	11.8	8.0	3.4
Gasoline upgrading	2.0	13.3	16.9	8.7	19.0	16.8	8.1	30.8
Miscellaneous	2.5	3.8	3.7	2.4	3.3	3.2	2.6	3.6
Taxes	5.9	7.1	6.9	6.7	7.8	8.2	6.5	10.3
Total	58.5	87.5	85.5	156.7‡	177.5‡	175.5‡	61.3	185.9‡
Total including specialties				81.7	86.5	91.5		176.4

*Devised by author for use in comparing the value of world competitive crude oils. †Part of these costs are included in other items. ‡Add cost of producing lubricating oils and waxes.

gasoline, results in a total gasoline that needs little upgrading.

Fig. 1 indicates how great can be the normal variations in operating cost for various types of crude oils. All of the crude oils were processed in the same general way, namely, topping, catalytic cracking, and some thermal cracking, but it is obvious that the amount of cracking varies with the gravity of the oils. The size of the refineries is about 30,000 bbl. per day (10,000 bbl. per day small refiner management, 20,000 bbl. per day major refiners) and the location is the Gulf Coast.

The solid points indicate a suitable amount (10 to 50 per cent of the potential) of lubricating-oil or wax manufacture, but not the processing of the entire crude oil for these specialty products. Thus, the processing of Pennsylvania crude oil on this same basis might involve operating costs of even $1.80 per barrel. The so-called Standard Realization Method developed by the author was used in assessing the operating costs. It differs from most methods of determining operating costs because it is based on significant properties of the crude oil and upon yields that will satisfy the world market, rather than on the type of operation or on refinery departmental costs.

Thus, the cost of operation is stated in terms of sulfur content, sourness, amount of cracking, characterization factor, octane number of gasoline products, etc., as indicated in Table 1. Operating costs for the United States should be slightly higher (5-8 per cent) because of the more intensive refinery practice and the higher octane numbers required by the United States market.

The effect of gravity generally is to increase the cost of operation, but note the special behavior of West Texas oils. Low-gravity West Texas oils contain so much sulfur (and in addition are sour) that the cost of refining decreases with increase in gravity.

How Much Profit Do Refiners Make?

How much of a profit do refiners make? Is a figure of 8 per cent too large?—S.W.P.

Accounting methods are so varied that one scarcely knows what various figures mean. However, the profits after taxes, according to McLean and Haigh (The Growth of Integrated Oil Companies, Harvard Graduate School of Business Administration, 1954, pages 140, 146, 252, and 333) have been somewhat as shown in Table 1.

TABLE 1—PROFITS AFTER TAXES, AS PERCENTAGE OF INVESTMENT (UNITED STATES)

			Integrated production, refining and marketing (own oil, 50-100%)	
	Refining and marketing (own oil, 0-10%)	Producing companies	Many companies	Seven large companies
1930	—2.0	9.5	3.0	5.2
1931	—1.0	0.0	—4.0	—1.9
1932	—4.0	7.0	—0.5	1.8
1933	—2.0	4.5	2.5	1.0
1934	—1.0	9.5	2.5	1.7
1935	4.0	9.0	4.5	4.5
1936	7.5	13.0	6.5	7.1
1937	6.0	15.0	8.5	8.2
1938	—3.5	12.0	3.5	3.7
1939	7.5	8.5	9.5	4.8
1940	6.0	7.0	7.5	5.7
1941	11.0	10.5	8.5	7.9
1942	8.0	10.0	7.5	6.7
1943	7.5	11.5	9.0	7.4
1944	11.0	12.0	10.5	8.5
1945	8.0	10.5	9.5	6.2
1946	10.5	11.5	9.0	8.8
1947	17.5	21.0	12.5	11.8
1948	22.0	25.0	17.0	16.1
1949	7.0	17.0	11.0	10.5
1950	9.0	13.5	12.5	11.8
1951	8.0	8.0	13.0	12.5
1952	12.5	12.0	10.0	10.7
Averages:				
1920-1934	4.0		5.1	
1935-1952	9.1		10.1	8.5
1920-1952	6.55		7.7	
1930-1939	1.15	8.7	3.6	3.6
1940-1952	11.5	14.1	11.5	9.6
1930-1952	6.8	11.6	7.9	7.0

Although the net profit appears to range from 7 to 14 per cent of the investment during reasonably favorable years, note that inflation has been helpful (about 9 per cent per year between 1946 and 1956) and that funds for expansion of the industry had to come, in part, from the profit. In view of these factors, the 6-14 per cent has been barely large enough to account for inflation and to provide new funds.

At the same time, the refiners have paid almost as much in taxes as they were able to retain for growth and inflation. Average company taxes at three dates have been:

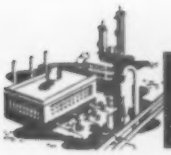
	Percentage of "Profit before Taxes"		
	Taxes	Profit	Ref.
1941—17 companies	24.3	75.7	1
1954—44 refiners*	41.1	58.9	2
1955—36 refiners*	41.5	58.5	3

*Omitting the companies that are mainly producers.

However, the proportion of taxes to profits ranged widely (from 64 per cent lower to 160 per cent higher than the average). Taxes now probably amount to about 9 per cent based on plant investment.

References

1. McLean and Haigh, The Growth of Integrated Oil Companies, Harvard School of Business Administration, 1954.
2. Adams, E., Pet. Engineer, May 1955, p. A63.
3. Adams, E., Pet. Engineer, May 1956, p. E2.



JOB IMPROVEMENT FOR THE PROCESS FOREMAN—71

Control Methods Used in Distillation Towers

IN A tower producing specification bottoms product, the bottoms temperature is controlled by varying the steam rate to the reboiler. Sometimes the temperature used for control is a few trays above the bottom since temperature changes are more pronounced at this point. The top temperature is not automatically controlled. Many reboiler type of towers use this type of control (see Fig. 16).

Flow control . . . Flow control is applied to distillation towers mainly for regulation of feed, product, and reflux rates. Regulation of product rates usually depends on level impulse from a storage drum and will be discussed under level control.

The system for control of reflux and feed rates is very simple, consisting of:

1. An orifice meter located upstream from the control valve.
2. A transmitter, which measures the pressure differential across the orifice plate and converts it to an electrical impulse.
3. The controller, which receives the impulse from the transmitter, records the rate, and counteracts deviations in the rate by operating a control valve.
4. The control valve is usually actuated by air pressure, which is varied by the controller. The air pressure acts on a flexible diaphragm within the regulating valve which, in turn, raises or lowers the valve stem to control the flow rate.

A diagram of this general arrangement is shown in Fig. 17.

Level control . . . Levels of material inside vessels can be controlled in several basic ways including:

1. Visual, by means of gage glasses.
2. Float-actuated such as tanks, level-trols on reflux drums, etc.
3. Electric.
4. Static pressure; for example, where tower pressure is controlled by product withdrawal.
5. Pressure differential.
6. Gama ray radiation such as used in surge separators on catalytic cracking units.

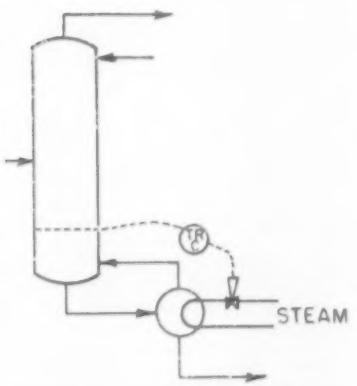
For the purpose of controlling levels associated with operation of reboiler type of towers, visual, float-actuated and, to a limited extent, pressure methods are in common use.

Tower Operating Troubles

Overloading . . . Tower overloading occurs when the liquid flow downward and the vapor rate upward are sufficiently high to cause flooding or puking. As these rates increase, the pressure drop across each tray increases.

The liquid level in the downspouts rise. The reason for this can be seen in Fig. 18.

This material is taken from "Fundamentals of Refining," operating manual of Magnolia Petroleum Co. refining division, Beaumont, Tex.



BOTTOMS TEMPERATURE is controlled by varying the steam rate to the reboiler. Fig. 16.

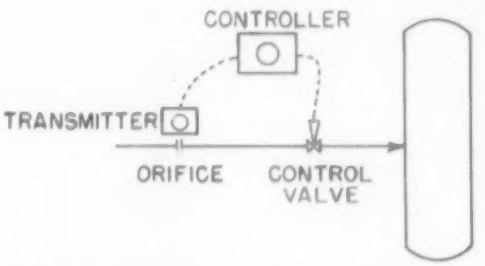
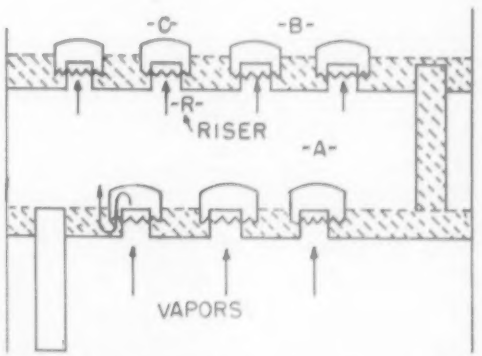


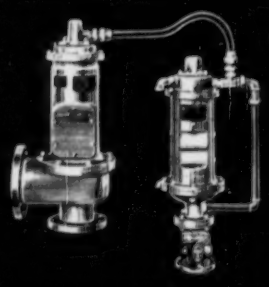
DIAGRAM showing arrangement for regulation of reflux and feed rates. Fig. 17.



PRESSURE at A must be greater than pressure at B. C is bubble cap. Fig. 18.

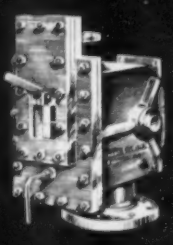
Fittings for Spheres too!

Semi-Automatic Tank Gauge and Sampling Lock, Fig. ST-9320 "DLB." Can be used for sampling and temperature thiefing. It is mounted here on S&J's Quick Opening Gate Valve, Fig. TT-135 which can be opened or closed with only half the number of turns required by other valves.



Pilot Operated Safety Relief Valve, Fig. ST-2500. Designed to protect tanks from excessive internal pressure. One pilot valve can serve one, two, or more main valves to meet high venting requirements. Main valve pallet is seated under pressure to moment of venting. This valve requires no great excess pressure for full venting capacity.

Vacuum Breather Valve, Fig. ST-1926. Designed to meet the unusual vacuum breathing requirements of pressure storage tanks, and to withstand high internal pressures when not in operation under a vacuum. This valve is automatically self draining, and utilizes a hinge type pallet.



High Pressure Automatic Tank Gauge, Fig. ST-400, will consistently and accurately measure product depths. Features new Safety Closure to protect extra thick Safety Glass. Gauge greatly reduces time required to measure tank contents accurately, because it can be installed at eye level height.

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ROCK-BIT DESIGN, SELECTION, AND EVALUATION—9

Cone-Tooth Depth, Spacing Affect Cutting Rate

by H. C. Bentson

LIMITATIONS in tooth design are imposed by a combination of structural requirements and formation charcteristics. Although the formation characteristics directly affect the geometry of the teeth, a clearer undertsanding of the design problem can be obtained by first considering only those factors which pertain to structural requirements.

From the previous illustrations it is apparent that the size of the cone and bearing structure may limit tooth depth. In other instances, however, the number and resultant spacing between the teeth of any given row and the included angle of the teeth may be the limiting factors.

For example, the tooth depth for any given row on a cone having closely spaced teeth may be limited entirely by the spacing and included angle. If this condition exists, either an increase in the spacing or a reduction in the angle would be necessary to obtain additional depth.

Spacing . . . From a strict structural consideration, tooth spacing is governed by tooth strength, depth, and included-angle requirements. Excessive spacing, combined with maximum depth and a normal included angle would result in tooth breakage due to unreasonably high values of lateral or side loading. But it should be obvious that teeth too closely spaced and within normal included-angle limits, would be excessively shallow.

Spacing, depth, and strength requirements determine tooth-included angle. The depth of closely spaced teeth usually must be reduced as a result of increases in the angle. Conversely, the depth of widely spaced teeth having a flat or a large radius at their root would not necessarily be affected.

In either case, however, the minimum values for included angle are limited by strength considerations.

Author is chief sales engineer, H. C. Smith Tool Co. Compton, Calif.

Soft formations . . . The inclusion in the tooth design of considerations involving formation characteristics further complicates the problem of the designer. For example, low compressive strength or soft formations require the use of deep, slender and widely spaced teeth.

Since the penetration rate in this type of formation is partially a function of the tooth depth, maximum tooth depth must be utilized within the limits dictated by the minimum requirements of cone-shell thickness and bearing structure size.

Included angles of the teeth must be reduced to the minimum allowed by strength considerations to permit complete tooth penetration with a minimum of weight. In addition, tooth spacing must be sufficiently large to induce easy removal of formation from between the teeth and minimize balling of the bit.

Hard formations . . . The structural requirements for high compressive strength or hard-formation bits are, in most cases, the direct opposite of those for soft-formation type of bit.

In comparison, the teeth on a hard-formation bit are shallow, heavy, and closely spaced. Due in part to the abrasiveness of most of the hard formations and, in part, to the chipping action of the bit, the teeth must be closely spaced to counteract rapid tooth wear and excessive lateral loading.

Tooth angles must be kept large to withstand the heavy loads required to overcome the compressive strength of the formation. The result of this combination of closely spaced and heavy teeth usually governs the tooth depth.

Tooth deletion . . . The incorporation of partial or complete deletions into the cutting structure geometry of some bits is necessary for obtaining optimum performance. In the softer, and to some extent in the medium formations, the characteristic of the formation is such that it may tend to pack within the spaces between the teeth. When this occurs, penetration by the teeth decreases, resulting in a serious reduction in penetration rate or balling of the bit.

Usually most of this packing occurs in the cross-section gage cutters and in the gage or outer rows of teeth on a cone bit. The sliding and gouging action of these teeth is more conducive to this phenomena.

Prevents tracking . . . In order to counteract the tendency of the teeth to pack with formation, adequate space between them must be provided. However, in many cases, the use of long widely spaced teeth on all of the cones or cutters would invite the teeth to track and generate a simulated gear-tooth pattern or ridges on the hole bottom.

The straddling effect by the sides of the teeth on these uncut ridges resists tooth penetration and as a result reduces the penetration rate. To break up this undesirable pattern at least one of the cones or cutters must carry more closely spaced teeth. Since this would again cause the teeth to pack with the formation, various deletion arrangements are required to develop adequate spacing while maintaining the required cutting characteristics.

The incorporation of deletions in the gage rows of teeth may provide additional benefits for other reasons. For example, in certain medium formations where no gage problems are experienced, the use of a deleted-tooth medium-formation bit will often result in an increased penetration rate. Since the more closely spaced teeth on the gage rows provide adequate cutting characterictics, the deletions may permit greater tooth penetration under lighter bit weights.

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Pipeline Patrol

. . . Report on Construction

Under Way, Contracted, and Planned

PIPELINE activity reported here is compiled from surveys conducted by The Oil and Gas Journal among pipeline companies and contracting firms. Projects listed include those proposed, contracted, and under way. Uncontracted projects are indicated by • preceding the project.

Crude-Oil Pipelines

• **El Paso Natural Gas Co.**
Project 80 miles of 8-in. and 300 miles of 10-in. crude and products line from Four Corners area to Salt Lake City.
Status: Planned.
Completion: August 1957.

Fulton, R. H. & Co., Lubbock, Tex.
Project: 39 miles of 6-in. from Donkey Creek field in northeastern Wyoming, southeast to the Osage pump station in Weston County.
Status: Fulton, a contractor has applied to Wyoming Public Service Commission. Application competes with that of Powder River Pipeline Co.

• **Humble Pipe Line Co.**
Project: 94 miles of 18-in. from Ector County to Kemper County, Texas.
Status: Planned.
Completion: February 1, 1957.

• **Interstate Oil Pipe Line Co.**
Project: 5 miles of 4-in. from South Bosco field, Louisiana, to present main line, and 5 miles of various size from Church Point field, Louisiana, to present main line.
Status: Proposed.
Project: 5 miles of 8-in. from McKamie Station to Magnolia Station, Arkansas.
Status: Under way.
Contractor: **J. C. Moore Construction Co.**

• **Offshore Gathering Corp.,** Houston.
Project: 364 miles of mostly 20-in. in Gulf of Mexico off Louisiana.
Status: Proposed.

• **Ohio Oil Co.**
Project: 504 miles of 8-in. from Teutopolis, Ill., to Spitzmesser, Ind.
Contractor: **O. R. Burden Construction Corp.,** F. W. Lewis, spread superintendent with office at Sheridan, Ind.; P. E. Thibodaux, spread superintendent with office at Rockville, Ind.
Project: 34 miles of 6-in. from Murphy Dome to Bonanza, in Big Horn basin, Wyoming, to connect with existing line there.
Status: Planned.

• **Pasotex Pipe Line Co.**
Project: 127 miles of 20-in. along its route from Wink to El Paso, retiring another dual 8-in. section.
Status: Planned.
Completion: July 31, 1957.

• **Powder River Pipeline Co.,** Fratt Building, Billings, Mont.
Project: 20 miles of 6-in. from Donkey Creek field near Moorcroft, Wyo., to Butte Pipe Line Co.'s line. (See Fulton, R. H. & Co., above.)
Status: Planned.

• **Service Pipe Line Co.**
Project: 30 miles of 3, 4, 6-in. to connect 16 new leases in Antelope, Charlson, Sanish, and Blue Buttes pool in McKenzie County, North Dakota, to its present gathering system.
Status: Under way.
Contractor: **Oil Field Services, Inc.**
Completion: Late 1956.
Project: 5 miles of 12-in. near El Dorado, Ark.
Contractor: **O. R. Burden Construction Corp.,** R. M. Jones, spread superintendent, office at El Dorado.

• **Shannon Oil Co.,** Denver.
Project: 34 miles of 6-in. from Murphy dome in Hot Springs County, Wyoming, to contact Ohio Oil Co.'s line in Big Horn County. Joint project with Farmers Union Central Exchange, Inc., and Mule Creek Oil Co., both of Billings, Mont.
Status: Under way.
Completion: December 1, 1956.

Shell Pipe Line Corp.
Project: 42 miles of 20-in. from Shell's Houston refinery to Brookshire Station.
Status: Under way.
Contractor: **Bill Murry & Co.;** Bill Murry spread superintendent, office 12629 South Main Street, Houston.
Completion: December 1, 1956.

• **Sinclair Pipeline Co.**
Project: 150 miles of 20-in. from Teague, Tex., to Houston.
Status: Planned.
Completion: 1957.

• **Tecumseh Pipe Line System** (Joint venture of Sinclair Pipe Line, Ashland Oil & Refining, and Pure Oil Co.)
Project: 190 miles of 20-in. between Griffith, Ind., and Cygnet, Ohio. Joint project with Sinclair Refining Co., Pure Oil Co., Ashland Oil & Refining Co.
Status: Awaiting pipe.
Completion: September 1957.

• **Union Oil Co. of California.**
Project: 225 miles of 16-in. from San Joaquin Valley to its refinery at Oleum, Calif.
Status: To start December 1, 1956.
Completion: Late 1957.

Products Pipelines

• **American Pipe Line Co.**
Project: Line from Gulf Coast to New York City area. Received ODM approval to amortize 40 per cent of $175,000,000 cost with a rapid writeoff.
Status: Planned.

• **El Paso Natural Gas Co.**
Project: 11 miles of 4-in. L.P.G. products from Snyder Line to South Andrews Plant, Texas.
Status: Planned.
Project: 80 miles of 8-in. and 300 miles of 10-in. products and crude line from Four Corners area to Salt Lake City.
Status: Planned.
Completion: August 1957.

• **Gulf Refining Co.**
Project: 45 miles of 8-in. from Pontiac Eastern Corp.'s planned refinery at Hattiesburg, Miss., (due on stream May 1957) to a connection with Plantation Pipe Line Co.'s system.
Status: Planned.
Project: 530 miles of 10-in. L.P.G. and natural gasoline line from Waddell Plant in Crane County, Texas, to Mont Belview near

Pipeline Patrol

Houston (368 miles is conversion from crude service).
Status: Under way.
Contractor: **Panama-Williams Corp.** has 46 miles from Waddell Plant to Midland. Remainder not let.

Phillips Petroleum Co.
Project: 66 miles of 12-in. from Borger, Tex., to Cassoday, Kan.
Status: Work started late October 1956.
Contractor: **Vedal Construction Co.**

• **Phillips Pipe Line Co.**
Project: 135 miles of 12-in. looping between Borger, Tex., and St. Louis.
Completion: December 31, 1956.

Plantation Pipe Line Co.
Project: 327 miles of 18-in. from Baton Rouge, La., to Helena, Ala.
Status: Under way.
Contractor: **Oklahoma Pipe Line Constructors;** N. L. Arie, spread man, office at Baton Rouge.
Completion, December 1956.

Shell Oil Co., Pipe Line Dept.
Project: 16 miles of 4-in. gasoline line from Wilmington, Calif., refinery to Los Angeles marketing depot.
Status: Under way.
Contractor: **Ledford Brothers.**
Completion: January 1, 1957.

• **Pure Transportation Co.**
Project: 8 miles of 10-in. from Smiths Bluff to Port Arthur Station of Evangeline Pipe Line System.
Status: To start December 1, 1956.
Completion: January 15, 1957.

• **Sioux Oil Co.**
Project: 80 miles of 4-in. from its Newcastle, Wyo., refinery to Rapid City, S. D.
Status: Planned.
Completion: Late 1956.

• **Southern Pacific Pipe Lines, Inc.**
Project: 300 miles of 6, 8, 10-in. to span the Sierras and connect San Francisco with Reno and Fallon, Nev., and to serve the Sacramento Valley.
Status: Planned.
Completion: August 1, 1957.

• **Union Oil Co. of California**
Project: 815-mile line from Rifle, Colo., to Los Angeles refining area, to carry products from its proposed Rifle shale-oil plant.
Status: Proposed.

Non-Petroleum Pipelines

American Gilsonite Co.
Project: 70 miles of 6-in. from Bonanza, Utah, to Grand Junction, Colo., to carry slurry of gilsonite from mines to refinery now being built.
Status: Under way.
Contractor: **Engineers Limited Pipe Line Co.**
Completion: Late 1956.

Dow Chemical Co.
Project: 16 miles of 4-8-in. brine lines.
Contractor: **Shamrock Construction Co.**
Completion: December 1956.

Natural-Gas Pipelines

• **Arkansas Louisiana Gas Co.**
Project: Line from Texas-Louisiana coastal region to northern Louisiana, to connect with their present system.
Status: Long-range plans.

• **Carolina Pipeline Co.**
Project: Distribution lines to serve 14 cities in Central South Carolina. Will buy gas from Transcontinental Gas Pipeline Co. or Southern Natural Gas Co.
Status: Has received South Carolina Public Service Commission permit.

Cities Service Gas Co.
Project: 9 miles of 16-in. and 4 miles of 8-in. near Springfield, Mo.
Status: Approved.
Contractor: **Prairie Construction Co.**
Completion: November 30, 1956.

• **Cities Service Pipe Line Co.**
Project: 27 miles of 6-in. from Lake Charles, La., to Orange, Tex.
Status: Planned.
Completion: April 30, 1957.

• **Coastal Transmission Corp.**
Project: 565 miles of 26-in. from McAllen, Tex., to Baton Rouge, to deliver to Houston Texas Gas & Oil Corp.'s proposed line to Florida. Also 272 miles of smaller gathering lines.
Status: Seeks FPC permit.

• **Colonial Natural Gas Corp.**
Project: Two systems; one between Houston-Lake Charles area and Miami, Fla.; one in the Carolinas and Georgia.
Status: Proposed.

• **Colorado Interstate Gas Co.**
Project: 238 miles of 22-in. from Laramie to Green River, Wyo. (last part of a 374-mile line between Denver and Rock Springs).
Status: Under way.
Contractor: **R. H. Fulton.**
Completion: January 1957.
Project: 26 miles of 8-in. loops at Cannon City, Colo.
Status: Planned.
Completion: December 1, 1956.
Project: 1957 program . . . 66 miles of 30-in., 40 miles of 34-in., 109 miles of 26-in., and 100 miles of 24-in. from Springfield, Colo., to Pueblo, Colo; 345 miles of 30-in. from Kit Carson, Colo., to Beatrice, Neb.; 50 miles of 22-in. from Laverne to Hooker, Okla.; 24 miles of 22-in. Panhandle field looping.
Status: Pending FPC approval.

Commonwealth Natural Gas Corp.
Project: 40 miles of 18-in. looping from Gum Springs to Chester, Va.
Status: Under way.
Contractor: **Pipeline Maintenance & Construction Co.**
Completion: January 15, 1957.

• **El Paso Natural Gas Co.**
Project: 193 miles of 34-in. between San Juan basin and Topock, Ariz., and 38 miles of 20-in. between San Juan mainline and Phoenix.
Status: Under way.
Contractor: Doing own construction.
Completion: February 1, 1957.
Project: 146 miles of 34-in. between San Juan basin and Topock.
Contractor: **Western Pipeline, Inc.**
Completion: February 1, 1957.
Project: 149 miles of 20-in. between San Juan mainline and Phoenix.
Status: Under way.
Contractor: **Western Pipeline, Inc.**
Completion: December 1, 1956.
Project: 29 miles of 30-in. from Lindrith Station to Chaco Plant, New Mexico.
Status: Planned.
Project: 29 miles of 18-in. from Panoma Plant to Dumas Plant, Texas.
Status: Planned.
Project: 84 miles of 34-in. looping on San Juan main line and 21 miles of 30-in. looping on Permian-San Juan line.
Status: Planned.
Completion: June 30, 1957.
Project: 23 miles of 20-in. from South Andrews Station to Shell's TXL Plant, Texas.
Status: Planned.
Project: 9 miles of 16-in. from Shell's TXL Plant to Goldsmith Plant, Texas.
Status: Planned.
Project: 8 miles of 26-in. Southern System second loop west of Gila Station, Arizona.
Status: Planned.
Project: 28 miles of 10-in. in Nolan and Coke counties, Texas.
Status: Under way.
Contractor: **McVean & Barlow.**
Completion: January 1, 1957.
Project: 37 miles of 6-in. from Dove Creek to Nucla, Colo., and 13 miles of 4-in. from Nucla to Urvan, to serve Union Carbide Nuclear Co. and Vanadium Corp. of America.
Status: Has FPC permit.
Project: 156 miles of 20 and 16-in. laterals from main line to Spokane, and 129 miles of laterals into Idaho.
Status: Under way.
Contractor: **R. H. Fulton & Co.**
Completion: Fall 1956.

Fish-Service & Management Corp. (Agent for Cascade Gas Co.)
Project: City distribution system—205 miles of 1 to 8-in. in Washington and Oregon.
Status: Under way.
Contractor: **Ted Price Construction Co.,** Electric, Tex. Three spreads—M. E. Pulliam, spread superintendent, office at Walla Walla, Wash.; K. D. Garrett, spread superintendent,

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office at Pendleton, Ore.; E. E. Hanks, spread superintendent, office at Baker, Ore.

Completion: 1957.

Hope Natural Gas Co.

Project: 22 miles of 8-in. in Logan County, West Virginia, and 20 miles of 3 to 8-in. in various West Virginia counties.

Status: Under way.

Contractor: **R & M Pipelines, Inc.,** Charleston, W. Va.

Completion: Late 1956.

- **Houston Texas Gas & Oil Corp.**

Project: 960 miles of 26-in. between Baton Rouge, La., and Miami, Fla., plus 500 miles of sales laterals in Florida, with main line joining Coastal Transmission's proposed line from McAllen, Tex., to Baton Rouge.

Status: Pending FPC approval.

- **Iron Ranges Natural Gas Co.,** St. Paul.

Project: 68-mile transmission line and 47 miles of laterals to supply towns on the Mesabi Iron Range, Minn.

Status: Application pending with FPC.

- **Kansas-Nebraska Natural Gas Co., Inc.**

Project: 11 miles of 12-in. from Scott City to Oakley, Kans., to replace equal quantity of 8-in.

Status: Has FPC permit.

Completion: December 1956.

- **Lone Star Gas Co.**

Project: 230-mile line from Cotton County, Oklahoma, to Fritch, Tex., and a 205-mile line from Snyder, Tex., to hook up with the Cotton-Fritch line. Being contested by Natural Gas Pipeline Co. of America.

Status: Application pending with FPC.

Michigan Consolidated Gas Co.

Project: 67 miles of 10 and 12-in. between Sears and Travers City, Mich.

Status: Under way.

Contractor: **Somerville Construction Co.;** Floyd Huduall, spread superintendent, office at Cadillac, Mich.

Project: 60 miles of 10 and 12-in. between Muskegon and Ludington, Mich.

Status: Under way.

Contractor: **Somerville Construction Co.,** jointly with **J. L. Gentry Construction;** Frank Morris, spread superintendent, office at Hart, Mich.

- **Michigan Wisconsin Pipe Line Co.**

Project: 142 miles of loops in Wisconsin and Illinois.

Status: Under way.

Contractors: **H. C. Price Co. and Houston Contracting Co.** Price will build 56 miles of 24-in., and Houston will build 42 miles of 20-in. and 51 miles of 16-in. (being handled by Latex Construction Co. of Georgia), spread office at Fond du Lac, Wis.

Project: 40 miles of 6, 4-in. looping in Wisconsin.

Status: Under way.

Contractor: **G. E. T. Construction Co.**

Completion: November 1956.

Project: 47 miles of 6, 4-in. looping in Iowa and Missouri.

Status: Under way.

Contractor: **Gabe's Construction Co.**

Completion: November 1956.

Project: 31 miles of 6, 4-in. new and loop lines in Michigan and Indiana, and 24 miles of 24-in. looping in Wisconsin.

Status: Has FPC permit.

Completion: 1957.

- **Midwestern Gas Transmission Co.**

Project: Will build main line from Portland, Tenn., to Canadian border near Emerson, Man.; 829 miles of 24-in., 109 miles of 16-in., 174 miles of 12-in., 648 miles of 3 to 18-in. extensions in Minnesota and Wisconsin.

Status: Application pending with FPC.

Montana-Dakota Utilities Co.

Project: 28 miles of 12-in. from Fallon County to Dawson County, Montana.

Status: Under way.

Contractor: **Ross Powers Coustruction Co.,** Billings, Mont.

- **Mountain Fuel Supply Co.,** Salt Lake City.

Project: 38 miles of line to connect with Pacific Northwest Pipeline Corp.'s system in Sweetwater County, Wyoming.

Status: Has temporary FPC permit.

- **Natural Gas Pipeline Co. of America**

Project: 350 miles of 20 and 26-in. from Jack and Wise counties, Texas, to Fritch, Tex., which is being contested by Lone Star Gas Co.

Status: Has FPC approval.

Project: 389 miles of 36-in. loops along its line from Beatrice, Neb., to Chicago, to take gas from proposed line of Colorado Interstate Gas Co., and for 91 miles of 30-in. loops along parts of its main line.

Status: Application pending with FPC.

Niagara Mohawk Power Corp.

Project: 272 miles of 2 to 12-in. distribution mains for growth of service area in central, eastern, and northern New York.

Status: Fifty per cent completed.

Contractors: Various.

Completion: December 31, 1956.

- **North Carolina Natural Gas Corp.** (Subsidary of Colonial Natural Gas Corp.)

Project: 575 miles of 3 to 16-in. from Transcontinental Gas Pipe Line Corp.'s system near Mooresville, eastwardly across north Carolina.

Status: Has permit from North Carolina Utilities Commission.

- **Northern Natural Gas Co.**

Project: 11 miles of 16-in., 81 miles of 12-in., 71 miles of 10-in. from Sioux Falls, S. D., to Aberdeen, S. D.

Status: Under way.

Contractor: **R. H. Fulton & Co.**

Completion: Late 1956.

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Project: 160 miles of 2, 3, 6, 8-in. branch lines to serve 20 new communities on Aberdeen, S. D., line.
Status: Under way.
Contractor: **Troth Construction Co.**
Project: 15 miles of 24-in. looping north and south of Hooper, Neb.
Status: Under way.
Contractor: **R. H. Fulton & Co.**
Project: 8 miles of various size branch lines to serve 8 new communities in Iowa.
Status: Under way.
Contractor: **Underground Constructors, Inc.**
Project: 73 miles of 20-in. from Savana Creek to Pincher Creek fields in Alberta, Canada; 32 miles of 24-in. from Pincher Creek to Montana border; 1,100 miles of 26-in. from Montana into Minneapolis.
Status: Planned.

• **Offshore Gathering Corp.,** Houston.
Project: 364 miles in Gulf of Mexico off Louisiana.; 60 miles of 24-in., 70 miles of 26-in., 234 miles of 30-in.
Status: Application pending with FPC.

• **Ohio Fuel Gas Co.**
Project: 19 miles of 5, 12, 16-in. to replace or loop present facilities serving Dayton and Toledo areas, and extend service to McCutchenville.
Status: Pending FPC approval.

• **Pacific Gas & Electric Co.**
Project: 37 miles of 20-in., 37 miles of 18-in., 9 miles of 12-in. from Beehive Bend field near Willows, Calif., to near Davis, then to Sacramento.
Status: Under way.
Contractor: **Engineers Limited Pipeline Co.**
Project: 135 miles of 34-in. looping of the Topock-Milpitas line.
Status: Under way.
Contractor: A joint-venture firm, **Midwestern-Johnson-Dixon,** has 85 miles to complete this year.
Completion: Major part to be laid in 1956; 62 miles in 1957.
Project: 200 miles of 12-in. from Sacramento Valley gas fields to Humboldt County, California.
Status: Has filed for approval of California's Public Utilities Commission. To start early 1957.
Completion: December 1, 1957.

• **Panhandle Eastern Pipe Line Co.**
Project: 82 miles of 4 to 12-in. gathering lines.
Status: Proposed. Bids have been requested.
Completion: December 31, 1956.

• **Peoples Natural Gas Co.**
Project: 4 miles of 12-in. from Evans City to Harmony, Pa.
Status: Planned. FPC permit not required.
Completion: January 1, 1957.

Permian Basin Pipeline Co.
Project: 19 miles of 16-in. in Andrews County, Texas.
Contractor: **R. H. Fulton & Co.**

• **Phillips Petroleum Co.**
Project: 14 miles of 2 to 10-in. in Carson County, Texas.
Completion: December 1, 1956.
Project: 54 miles of 2 to 10-in. in Hutchinson County, Texas.
Completion: January 1, 1957.

• **Piedmont Gas Co.,** Hickory, N. C. (Parent is Carolina Natural Gas Corp.)
Project: 78 miles of 2 to 8-in. extension off Trancontinental in North Carolina to serve Gaston, Lincoln, Catawba, Caldwell, and Burke counties.
Status: Application pending with FPC.

Southern California Gas Co. and Southern Gas Co. of California
Project: 241 miles of 30-in. from the outskirts of Los Angeles to Topock on the Arizona-California border.
Status: Right-of-way and ditch under way; pipe laying begins in January, 1957.
Contractor: **R. H. Fulton & Co.**
Completion: June 30, 1957.
Project: **49 miles** of 30-in. from Newhall to Alhambra, Calif.
Status: Under way.
Contractor: **Joe E. Young Contractors, Inc.,** has 19 miles from Encino to Newhall, Calif. **Macco Corp.** has 16 miles from Encino to Glendale, Calif. **Alex Robertson Co.** has 14 miles from Glendale to Alhambra, Calif.
Completion: December 1, 1956.

Spokane Natural Gas Co.
Project: 400 miles of 1 through 24-in. distribution system at Spokane.
Status: Under way.
Contractor: **Hallmac Construction Co.;** V. L. Williams, spread superintendent, office at Spokane.
Completion: 1957.

• **Tennessee Gas Transmission Co.**
Project: 221 miles of 30-in., 101 miles of 26-in., and 10 miles of 24-in. looping from Portland, Tenn., to Greenup, Ky.; from Morehead, Ky., to Catlettsburg, Ky.; from Catlettsburg to Broad Run, W. Va.; from New Wilmington, Pa., to Mercer, Pa.; and from New Castle, Pa., to near Pittsburgh, Pa.
Status: Pending FPC approval.
Project: 51 miles of 26-in., 51 miles of 20-in., and 17 miles of 12-in. gathering lines from Kinder, La., to offshore fields in Gulf of Mexico.
Status: Pending FPC approval.
Project: 577 miles of 30-in. from Mississippi River delta area south of New Orleans to Portland, Tenn.
Status: Pending FPC approval.

• **Texas Eastern Transmission Co.**
Project: 422 miles of 30-in. from near McAllen to Beaumont, Tex., to move imported Mexican gas; 45 miles of 24-in. laterals from McAllen to Provident City, Tex., 77 miles of 30-in. looping between Kosciusko, Miss., and Uniontown, Pa.; 147 miles of supply and sales laterals.
Status: Under way.
Contractor: **Houston Contracting Co.** has 121 miles of 30-in. between Angleton and Vidor, Tex., to start March 1, 1957. **H. C. Price Co.** has 70 miles of 30-in. **H. B. Zachry Co.** has 201 miles of 30-in. starting near McAllen and running northeast to near Angleton, Tex. **Grayco Constructors, Inc.** has 45 miles of 24-in. laterals from Blessing to Provident City. **Western Pipe Line, Inc.,** Austin, has 30-in. crossings at Nueces, Lavaca, and Carancahua bays. **Missouri Valley Dredging Co.,** Omaha, has crossings at Hinds and Guadalupe bays.
Completion: Fall 1957.

Texas Gas Transmission Corp.
Project: 120 miles of 20-in. and 11 miles of 16-in. from near Eunice, La., east to near Thibodaux, La.
Status: Work started late October.
Contractor: **Houston Contracting Co.** Spreads: 11 miles of 16-in. and 50 miles of 20-in. from near Eunice to near New Iberia, F. A. Silar, spread superintendent, office at Crowley, La.; 45 miles of 20-in. from near New Iberia to near Morgan City, M. L. Thompson, sperad superintendent, office at Franklin; 25 miles of 20-in from near Morgan City to near Thibodaux, W. H. Hayes, superintendent, office at Thibodaux.
Completion: December 1956.

• **Trans Carolina Pipe Line Corp.,** Commercial Building, Raleigh, N. C.
Project: 300-mile system across North and South Carolina, plus 500 miles of laterals.
Status: FPC approval pending

• **Transcontinental Gas Pipe Line Corp.**
Project: 25 miles of 36-in. loops from Louisiana to South Carolina, 31 miles of 36-in. and 43 miles of 30-in. line.
Satus: Pending FPC approval.

United Fuel Gas Co.
Project: 15 miles of 12-in. in Kanawa County, West Virginia.
Status: Under way.
Contractor: **Williams-Austin Co.;** O. L. Martin, spread superintendent, office at Charleston, W. Va.
Completion: November 1956.

Foreign Crude-Oil Pipelines

Arabian American Oil Co.
Project: 140 miles of 20-in. from Safaniya field to Ras Tanura, Saudi Arabia.
Status: Under way.

• **B-A Alberta Pipe Line, Ltd.**
Project: 35 miles of 8-in. to connect Drumhell field, Alberta, with existing lines running to Edmonton.
Status: Pending approval.

• **Interprovincial Pipe Line Co.**
Project: 151 miles of 20-in. to extend present line from Sarnia to Port Credit, Ont.
Status: To start spring 1957.
Completion: Fall 1957.

• **Mene Grande Oil Co.**
Project: 11 miles of 6-in. from Elias to Fria, and 10 miles of 10-in. from Limon to Leona-Dacion lateral, Venezuela.
Completion: First quarter 1957.
Project: 24 miles of 12, 14, 16-in. from Oficina Tank Farm to Oveja.
Completion: Late 1956.

Pembina Pipe Line, Ltd.
Project: 100 miles of 3 to 10-in. gathering system in Pembina field.
Contractor: **Sparling Davis Co., Ltd.**
Project: 200 miles of 3 to 12-in. gathering line in Pembina oil field.
Contractor: **Mannix, Ltd.;** F. Whitlow, spread superintendent, office at Pembina oil field.

• **Royal Dutch-Shell**
Project: 700-mile line across Europe from the Mediterranean to the North Sea, running through Eastern France, Luxembourg, West Germany, and Netherlands, and Belgium. Main trunk to be 30-in.
Status: Company is considering project together with several other companies.

• **Sinclair Oil Corp. and Socony Mobil Oil Co.**
Project: 211 miles of 20-in. from the Silvestre field in Barinas, Venezuela, to Puerto Cabello on Caribbean Sea.
Status: Under way.
Contractor: **Williams Brothers Sudamericano, Ltd.**

Union of Soviet Socialist Republic
Project: 2,300-mile Trans-Siberian crude and products line from Ufa and the Tuimaza fields in Bashkiria to Irkutsk near Lake Balkal.
Status: Under way.

Yacimientos Petroliferos Fiscales (Argentina)
Project: 700 miles of 12-in. from Campo Duran to San Lorenzo.
Status: Under way.
Contractor: **TECHINT** (Compania Tecnica Internacional), Buenos Aires, has 90 miles.

Yacimientos Petroliferos Fiscales Bolivians (Y.P.F.B.)
Project: 160 miles of 10-in. and 43 miles of 8-in. from Sicascia to Arica on the Chilean coast.
Contractor: **Williams Brothers Co.**
Completion: December 1957.

Foreign Products Pipelines

• **Estrada de Ferro Santos a Jundial Departamento Oleducto**
Project: 6 miles of 14-in. from Capauva refinery to Utinga Terminal.
Status: Planned.
Completion: December 1956.

Hydrocarbons Pipeline Co. (Subsidiary of Canadian Hydrocarbons)
Project: 800 miles of 6 and 8-in. L.P.G. line from near Edmonton, Alta., to Fort William, Ont.

Pipeline Patrol

Status: Has permit from Parliament of Canada. If approved by Federal Board of Transport Commissioners and the Alberta Petroleum and Natural Gas Conservation Board, work will start early 1957.

Construction consultants: **Dutton-Williams Brothers, Ltd.**, Calgary, and **A. D. Little & Co.**, Boston.

• **Iraq Petroleum Co., Ltd.**

Project: 75 miles of 24-in. from Homs, Syria, to Tripoli, Lebanon.

Israeli Government

Project: A 6-in. line from the Haifa refinery to Tel Aviv.

Completion: Late 1957.

National Iranian Oil Co.

Project: 573 miles of 10-in. from Ahwaz to Teheran, Iran.

Contractor: **Enterpose of Paris,** has northern 236 miles. Southern section completed.

• **North Atlantic Treaty Organization (NATO)**

Project: 2,000 miles of lines to airfields in parts of Europe.

Status: Under way.

Contractors: **Associated Pipeline Contractors, Inc.,** has 450 miles from Iskenderun, Turkey, to Batman. **TECHINT** (Compagnia Tecnica Internazionale), Milano, **Italy,** has 205 miles of 4-in. from Bandirma to Eskisehir, Turkey, and 250 miles of 8-in. from Antalya to Eskisehir. Bids were taken in January 1956 on 300 miles of 12-in. between Marseille and Langres, France.

United States Defense Department

Project: Sponsoring 485 miles of 8, 10, 12-in. from Cadiz to Zaragoza, Spain.

Contractors: Prime contractor — **Brown-Raymond-Walsh; Merritt Chapman & Scott, Benson & Montin** of Oklahoma City, **Agroman Construcion Co.** of Spain.

Yacimientos Petroliferos Fiscales Bolivianos (Y.P.F.B.)

Project: 190 miles of 4-in. from Camiri to Santa Cruz.

Contractor: **Williams Brothers Co.**

Completion: December 1956.

Foreign Natural-Gas Pipelines

• **Alberta Gas Trunk Line Co., Ltd.**

Project: 637 miles of 34 to 16-in. gathering lines in Alberta.

Contractor: **Dutton-Williams Brothers, Ltd.,** has preliminary studies, design and management-engineering.

Completion: Approximately 40 miles to be completed in 1956; remainder in 1957 and 1958.

Andes Pipeline Corp. (Subsidiary of Glenn McCarthy, Inc.)

Project: 500 miles of 12-in. from McCarthy's Bolivian concession to the Chile copper-mining area.

Contractor: Will do own work.

• **Attock Oil Co.**

Project: 60 miles of line from Dhulian field to Rawalpindi in West Pakistan.

Status: Planned.

Cia. Shell de Venezuela.

Project: 177 miles of 20-in. from La Paz field in the Maracaibo district, to the Cardon refinery on Paraguana Peninsula, to fuel refinery furnaces.

Status: Under way.

Completion: 1957.

• **Empresa Nacional Del Petroleo.**

Project: 80 miles of 10-in. from Concon to Santiago, Chile.

Status: Planned.

Project: 130 miles of 22-in. to parallel a 14-in. line from Reynosa to Monterrey in northern Mexico.

Imperial Oil, Ltd.

Project: 37 miles of 12-in. from Waterdown to North Toronto, Ont.

Status: Under way.

Contractor: **Majestic Contractors, Ltd.,** Odis Hare, spread superintendent, office at Cooksville, Ont.

Inland Natural Gas Co., Ltd.

Project: 350 miles of 12 to 4-in. system in British Columbia, and 400 miles of distribution piping in 31 towns.

Status: Clearing and grading under way.

Contractor: **Dutton-Williams Brothers, Ltd.;** Pat Campbell, project manager, office at Penticton.

Completion: September 1957.

Mid-Western Industrial Gas, Ltd.

Project: 18 miles of 6-in. from the new gas plant at Redwater, Alta., to the nickel plant at Fort Saskatchewan, including a crossing of the North Saskatchewan River.

Status: Under way.

Contractor: **Fulton Banister, Ltd.**

Completion: Fall 1956.

South Alberta Pipe Line, Ltd.

Project: 150 miles of 8-in. from Etzikom field to serve a nitrochemical plant to be built near Medicine Hat, Alta.

Status: Filed for permit.

Sui Gas Transmission Co.

Project: 188 miles of 16-in. from Sui gas field to Moultan, Pakistan.

Status: Under way; to be extended later to Lahore with branches at Kot Addu, Jhang Magiana, and Montgomery.

Contractors: **Pakistan Constructors,** a joint company of **Morrison-Knudsen** of Boise, Idaho, and **William Press, Ltd.,** of London.

• **Technical Office of Hydrocarbon. Ministry of Mines and Petroleum, Government of Venezuela.**

Project: 321-km., 26-in. line from Anaco to La Mariposa near Caracas.

Status: Proposed.

• **Trans-Canada Pipe Lines, Ltd.**

Project: 574 miles of 34-in. from the Alberta-Saskatchewan border to Winnipeg. (First part of 2,250-mile line from Alberta to Toronto and Montreal.)

Status: Under way.

Contractors: **Majestic Contractors, Ltd.** (104 miles from Burstall to Stewart Valley, Sask., R. L. Leaonard, spread supt., office at Cabri.; **Canadian Bechtel, Ltd.** (110 miles from Swift Current to Moose Jaw, Sask., J. L. Work, general superintendent, office at Moose Jaw); **Mannix, Ltd.** (90 miles from Moose Jaw to Welseley, spread superintendent, T. Anderson, office at Montmartre, Saskatchewan); **Dutton-Williams Brothers, Ltd.** (87 miles from Deveren to Moosomin, to start in 1957). **H. C. Price Co.** has 100 miles to start in 1957.

Union of Soviet Socialist Republic.

Project: 900 miles of 26-in. from Stavropol in the Northern Caucasus to Moscow. The line, larger than Russia's other two major gas lines which are only 16 and 18-in., will serve Voroshilovgrad, Voronezh, Tula, Yelets, and Serpukhov.

Status: Under way; approximately 50 per cent completed.

Westcoast Transmission Co., Ltd.

Project: 650 miles of 30-in. from Peace River area, Canada, to Sumas, Wash.

Status: Under way.

Contractors: **Dutton-Williams Brothers, Ltd.,** has 120 miles from Taylor, B. C., to Azouzetta Lake, T. E. Davis, spread supt., office at Dawson Creek, B. C.; **Mannix, Ltd.,** has 110 miles between Huntingdon and Merritt, Fred Byers, spread superintendent, office at Chilliwack; **Canadian Bechtel, Ltd.,** has 210 miles from Alexandria to Pine Pass, B. C., H. F. (Hank) Mogg, spread man, office at Quesnel, B. C.; **R. A. Conyes Construction Co.,** has 210 miles.

Completion: Dutton-Williams section to be completed November 1957. R. A. Conyes section and Canadian Bechtel section to be completed September 1957.

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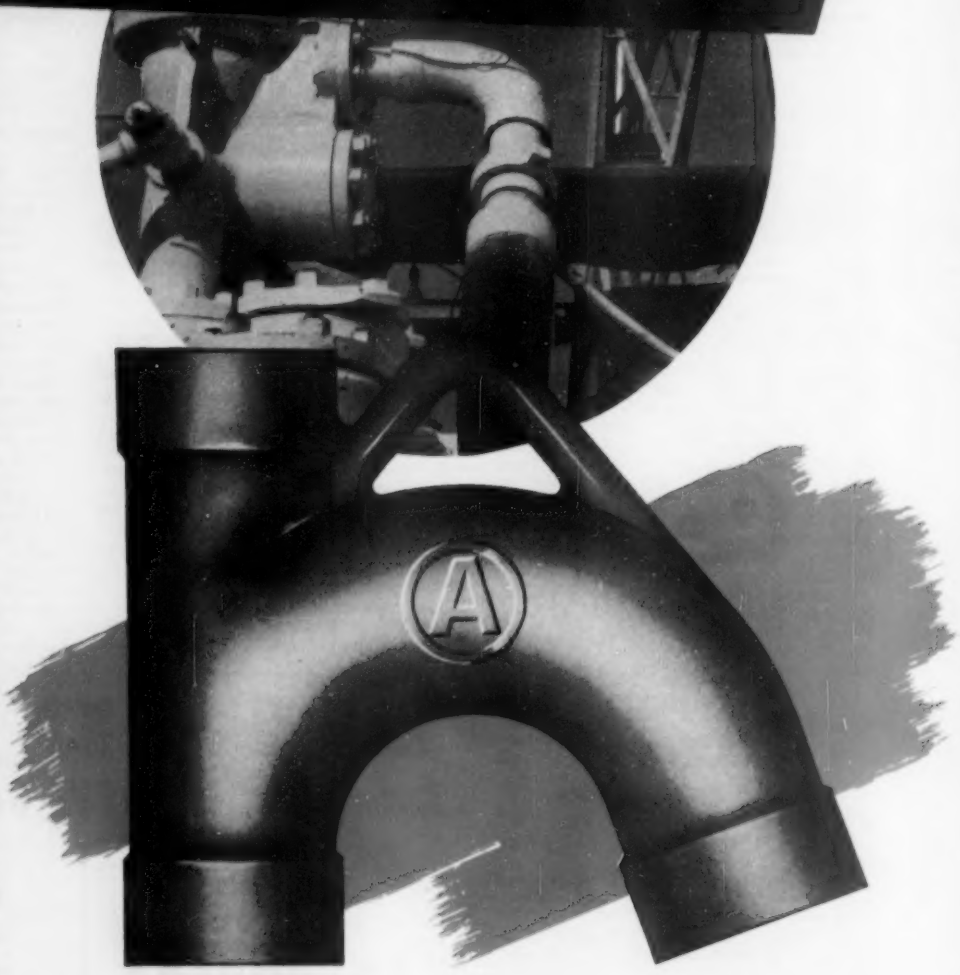

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Drilling Contractors

ALVIN H. HOWARD

D. E. VASSAR

DELTA OFFSHORE Drilling Co.'s newly launched offshore mobile drilling unit. At right are company chiefs: Alvin H. Howard (top), chairman of the board, and D. E. Vassar, president.

Delta Puts Mobile Drilling Unit In Louisiana Offshore Operation

DELTA OFFSHORE DRILLNG CO., of New Orleans, is putting its first offshore mobile drilling unit in operation as the latest addition to the large and rapidly growing fleet of such equipment being used by contractors in oil and gas exploration and development in the Gulf of Mexico off the Louisiana coast.

Its first operation is in the Bay Marchand area, off the coast of Lafourche Parish, where it is under contract to California Co.

The unit is designed for operation in water depths up to 25 ft., and equipped for drilling to depths of 20,000 ft. The vessel is of the self-stabilizing submersible type with drilling and machinery decks supported on fixed columns, secured to the hull. All drilling units are diesel-electric driven.

Vessel and structure design was by Friede & Goldman, Inc., naval architecturing and marine engineering firm, of New Orleans, construction was at Avondale Marine Ways, also at New Orleans. Total rigged-up cost was slightly under $2,000,000.

Drilling equipment, supplied through Mid-Continent Supply Co., includes a Unit Rig 1220 draw works, two Emsco D-700 mud pumps, and Ideco 27½-in. rotary table. It uses a Lee. C Moore 140-ft. derrick with a 30-ft. base, mounted on a galvanized steel substructure. Main power plant has three Alco diesel-electric generator units, one driving two 500-kw. d.c. generators; the second, two 500-kw. d.c. generators and one 250-kw., 450-volt, 3-phase, 60-cycle a.c. generator; and the third, one 500-kw. d.c. generator, and one 250-kw., 450-volt, 3-phase, 60-cycle a.c. generator.

The unit is provided with air-conditioned crew quarters for 32 men, offices, dining salon, and recreation room; helicopter deck; Schlumberger well-surveying and logging unit; Halliburton cementing unit; and a Mecca vapor-compression distillation unit capable of supplying 7,200 gal. of fresh potable and drilling water per day.

Delta Offshore Drilling Co., a comparatively new organization, is headed by Alvin H. Howard as chairman of

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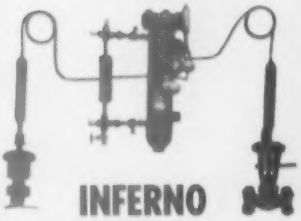

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Lynn D. Durham of Durham Drilling Co. now buys Mudwonder Mudline Valves to cut operating costs.

Edward Valves, Inc., Subsidiary of Rockwell Manufacturing Company, East Chicago, Ind.

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the board of directors, and D. E. Vassar as president.

Penrod Drilling Co., Shreveport, has taken a contract for another far-offshore wildcat test Gulf Refining Co. is undertaking. Its location, in Block 128, South Timbalier area, Gulf of Mexico, is more than 25 miles from the Terrebonne Parish coastline.

Marshall R. Young Drilling Co., Brookhaven, Miss., and **H. L. Rowley, Inc.,** Shreveport, are the respective contractors on two deep tests Allen E. Humphrey and associates, of Dallas, are starting in Tensas Parish, eastern Louisiana. Young's job is at 1 Washington, in 27-10n-10e, just east of Troy and about 2½ miles west of Waterproof. Rowley is drilling 1 Goldman, in 13-10n-11e, about 4 miles northeast of the first. Both contracts are for 9,200 ft. with the Lower Cretaceous as their objectives.

Gulf Drilling Co. has contracted for a 10,700-ft. test to be drilled for Lyons & Logan in northwestern Beauregard Parish, southwestern Louisiana. Location, in 16-3s-11w, is 2 miles north of Neale field. It is carried as 1 Keel.

Meredith & Co., Houston, is well along on a wildcat test it is putting down for Kilroy Co. of Texas and Slick Oil Corp. in southwestern Beauregard Parish, near the Texas-Louisiana boundary (Neches River). It is a 9,000-ft. test at 1 Columbia, in 33-6s-13w. Location is 1½ miles southwest of West Fields.

H. L. Edwards Drilling Co., Houston, has been given a contract for another deep test Pan American Production Co., with Austral Oil Exploration Co. and Magnolia Petroleum Co., as joint operators, will drill in the South Thornwell area, on the Jefferson Davis-Cameron parish line, in southwestern Louisiana. Edwards' job is at 1 Henderson-Petijean Unit, in 24-11s-5w, about a mile north of nearest production on the Jefferson Davis Parish side of the line. **Drilling & Exploration Co.,** also of Houston, has been keeping two rigs working for the same operators in this area. Outpost drilling around this field is to depths below 15,000 ft.

Drilling & Exploration Co., Inc., Houston, has a new contract operation going in southeastern Smith County, Mississippi. It is a 12,500-ft. Lower Cretaceous test for George D. Hunt and Dick Quin. Location is about 2 miles northwest of the deep, Lower Cretaceous Soso field. It is on the operators' Ford lease, in 24-10n-14w.

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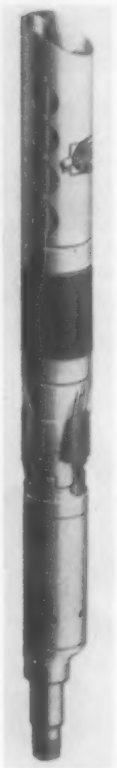
The OIL AND GAS JOURNAL

Showcase

OF NEW EQUIPMENT AND LITERATURE

by Dan B. Miller

New Packer Comes With or Without Hydraulic Anchor

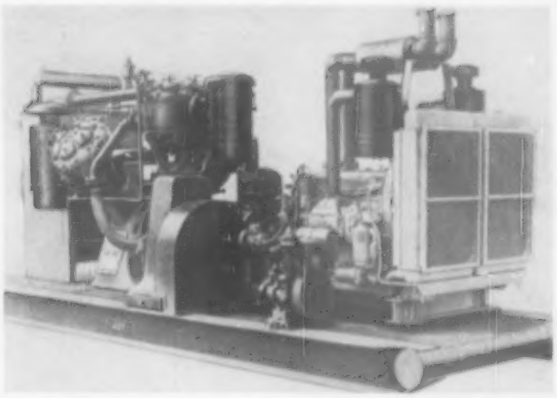


A new retrievable dual-string packer operates in wells of any depth. Available with or without hydraulic anchor, this packer features an all-steel head and heat-treated alloy-steel slips, dovetailed for safe, smooth operation.

The mandrel is one-piece seamless-steel tubing securely keyed in all positions, allowing tubing torque in either direction. Seal rings made of special oil and gas-resistant compound prevent leakage along the mandrel. The packing rubber is a one-piece sleeve type, made of special oil and gas-resistant compound which will not vulcanize in the well.

A jay-hook stinger which may be latched into the packer is furnished on packers with anchor and a plain stinger on packers less anchor, unless otherwise specified. Anchor piston slips have a large piston area and are made of heat-treated alloy steel. O-ring seals prevent leakage around the piston slips which are keyed to the anchor body in such a way that teeth are always in proper position for maximum grip on the casing.

Available sizes are 5½ by 1¼ by 1¼ in. ten-round upset, 5½ by 1½ by 1½ ten-round nonupset, and 7 in. or 7⅝ by 2 by 2 in. E.U.E. eight-round in a full range of casing weights. Adapters are also available for conversion to 2-in. C.S. Hydril. Packers are easily dressed in the field and may be rerun repeatedly. **For more information write or call: The Guiberson Corp., P. O. Box 1106, Dallas, Tex.**



Package Compressor for Air Drilling

Designed for air drilling, the new semiportable package compressor plant is skid-mounted. Called the AP-2, it mounts two heavy-duty, stationary compressors. It is powered by either diesel or natural-gas engines. It delivers 1,056 cu. ft. per minute for 125 psig., and 647 cu. ft. per minute for 250 psig., thus meeting demands for large volumes of air at low pressures, yet also supplies high-pressure air at reduced volume.

Mounted on a single heavy-duty oilfield skid, the plant is within nonpermit road limits for highway transportation. Piping-up at the drill site is all that's required to go to work.

Simple lever controls at the driller's

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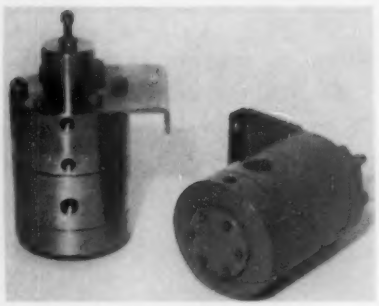
console permit remote-control regulation of working pressures and complete compressor unloading without signals to an extra man, or loss of time traveling between the drill rig and the compressor unit. Regulation provides for automatic loading and unloading at maximum discharge pressure. **For more information write or call: Joy Manufacturing Co., Oliver Building, Pittsburgh, Pa.**

Vaporizer Regulator Controls Liquid Samples

A new vaporizer regulator assures vaporization and permits pressure control of liquid samples being introduced into analyzers and other petrochemical-monitoring instruments. Known as the Type 38-001 vaporizer regulator, it was designed by Phillips Petroleum Co. for use with infrared analyzers and refractometers to assure that liquid samples introduced into these and similar instruments would be in the vaporized state and at pressures of about 15 psi. It functions in continuous-sample



systems of many analysis instruments. The unit has been field-tested at Phillips' refineries.

A cylinder 3⅜ in. in diameter and 6½-in. thick, the unit consists of four precision-machined stainless-steel segments bolted to make a cylindrical sandwich. An aluminum model is available.

Built to operate at inlet pressures of up to 150 psi., the regulator will hold pressure constant within 0.10 psi. when upstream variations do not exceed 10 psi. Outlet pressure may be regulated from 0 to 50 psi. Maximum steam pressure is 50 psig. and maximum heater output, when heating element is used instead of steam, is 75 watts. **For more information write or call: Consolidated Electrodynamics Corp., 300 North Sierra Madre Villa, Pasadena, Calif.**

•

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Portable Instrument Measures And Records Totals pH Range

This portable, self-contained, pH measuring and recording instrument needs no external power supply. It serves in field surveys of stream pollution, waste-treatment-plant effluent, and industrial water supplies.

Consisting of two units, it covers the total pH range of 0-14 in two partial ranges of 0-8 and 6-14. The recorder uses carbon-coated 8-in.-diameter charts, and makes a record with a

GELLED FLUIDS INCREASE FRACTURING EFFECTIVENESS

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The unusually high percentage of success during the past seven years leaves no doubt as to the effectiveness of Halliburton's HYDRAFRAC process. Where well conditions are favorable and oil and gas bearing formations are suitable, the HYDRAFRAC process is still the most dependable, economical hydraulic fracturing method.

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Gelled hydrocarbon fluids used in the Hydrafrac process have excellent sand-carrying characteristics and low fluid loss. Special chemicals, added to or following the gel, cause this viscous fluid to revert to a thin solution within a few hours, allowing easy return to the well bore. This solution is nearly always compatible with the well fluid. Halliburton's continuous sand-proportioning equipment is designed to permit accurate, instant control of sand-fluid ratio during the Hydrafrac treatment. Formulations of this fracturing fluid may be varied to give stability under a wide range of pressures and temperatures.

For production at a higher rate, and maximum ultimate recovery, Hydrafrac Service can be the most economical way to turn potential into profit. Call your local or district office of the Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

COMPLETE DATA SENT ON REQUEST

This is one of Halliburton's many fracturing processes. Get the informative "Elements of Hydraulic Fracturing" for your Halliburton Service File.

HALLIBURTON FRACTURING SERVICES

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vibrating stylus. The chart drive rotates the chart in either 1 hour or 24 hours, depending on the application.

The two units together weigh less than 50 lb. and are easily moved. A manual adjustment compensates for the temperature of the liquid being tested. **For more information write or call: The Bristol Co., Waterbury 20, Conn.**

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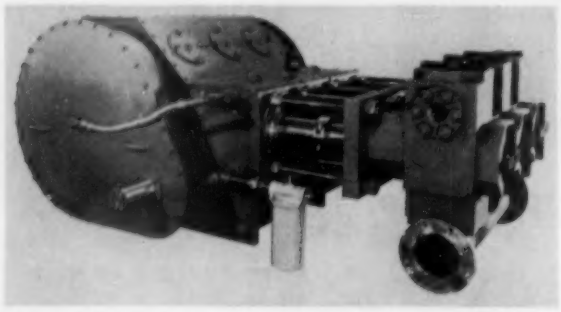

New Pump for Cementing Service

The new Series 5,000 triplex plunger pump offers working pressures up to 10,000 psi. for cementing and fracturing service. The main frame is made of steel plates with forged bearing housings welded in. Curved steel plates are welded above and below the housings, tying the whole into the rigid nonweaving unit. The main frame houses four roller bearings. These bearings are 16 in. in diameter, 3 in. wide, and have a thrust-loading capacity of 190,000 psi. each.

The lubrication system is operated by an independently operated pump. It applies lubrication pressure before the plunger pump is operated. This provides good lubrication at slow speeds.

Some of the pump's specifications include: plunger sizes to 6½ in.; working pressures to 10,000 psi.; 750-hp. maximum net; 210-s.p.m. maximum; 200,000 lb. maximum plunger loading. Over-all dimensions are 55 by 38 by 93 in. **For more information write or call: Twentieth Century Manufacturing & Supply Co., P. O. Box 9666, Tulsa, Okla.**

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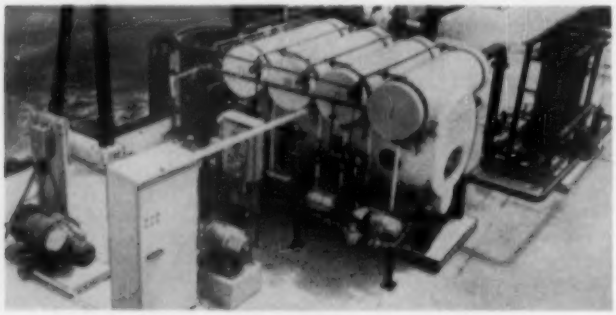

Sea Water Distilled by New Plant

A new multiple-stage flash-distilling plant produces distilled water of high purity from normal sea water. During a test run of 1 month, a four-stage unit produced above its capacity of 1,000 gal. of distillate per hour while producing water with less than ¼ grain per gallon of total solids.

The distilling plant utilizes low-level heat such as waste heat from diesel engines. Or it can utilize inexpensive high-level heat, such as oil-field flare gas. Compact in size, the plant offers a wide range of capacities. This permits use on surface ships, offshore-drilling rigs, and portable rigs. The only moving parts are the pumps. No compression is necessary and the unit therefore has a low noise level. **For more information write or call: Badger Manufacturing Co., Cambridge, Mass.**

●

Shape of New Rotary Simplifies Installation

A new rotary machine incorporates several improvements. Foremost among these improvements is the rectangular shape of the machine, including the removable top guard. This simplifies installation in the derrick substructure and permits rig flooring to be fitted up flush with the table top on all four sides for safer working areas.

The new machine includes a cartridge type of pinion-shaft assembly, which assures permanent alignment of bearings and an easy means of adjusting the pinion with the gear without disturbing alignment.

Another feature is a unitized table and bearing assembly. The main and

holddown bearings mount in the rotary. The bearing assembly has been simplified in that the lower race of the main bearing acts as the upper race of the holddown bearing. This design permits removal of the table assembly and all bearings from the housing without disturbing the working position of the bearings or their adjustment.

A direct table lock prevents tonging shocks and strain on the pinion, gear, and pinion-shaft bearings. It has eliminated the use of a lock ring on the pinion shaft.

Accessibility of all fittings and operating parts from the top of the table guard is another advantage. These parts include lock pawl handles, oil-filler cap, dip stick, and lifting trunnions.

Positively induced oil circulation for pinion and gear, main, holddown, and pinion-shaft bearings is a new feature. No grease is used for lubricating the rotary. Approximate over-all dimensions of the rotary are 81½ by 50½ in. and a depth of 23½ in. Weight is

7,065 lb. **For more information write or call: The National Supply Co., 2 Gateway Center, Pittsburgh, Pa.**

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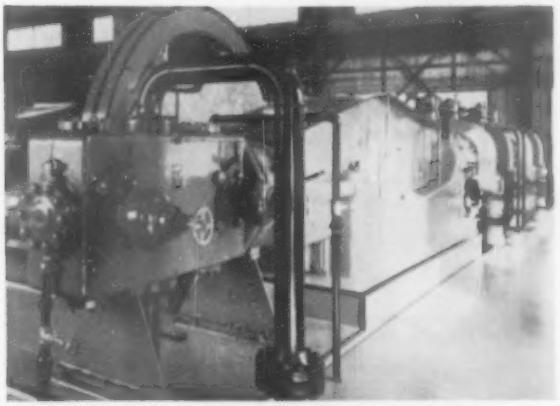

Converted Compressors Handle 2,000 Psi.

Through the application of compressor cylinders built of nodular iron, older horizontal compressors will convert to handle 2,000 psi. for modern transmission and gas-storage service. Converted compressors now serve in the Rockport and Ripley compressor stations of United Fuel Gas, Charleston, W. Va.

The compressor cylinders designed for 2,000-psi. service are supplied by Cooper-Bessemer Corp. for its own Type 22 units. Each of seven horizontal compressors at the Ripley and Rockport stations is equipped with the nodular cylinders. Of two-volume design, the cylinders permit 19 steps of unloading per compressor. Flexibility of operation accommodates wide variations in pressure ranges.

With the two-volume compressor cylinders, gas to storage can be handled at 620 to 685-psi. suction and 1,000 to 1,800-psi. discharge. Delivery out of storage is handled at 800 to 1,500 discharge. **For more information write or call: The Cooper-Bessemer Corp., Mount Vernon, Ohio.**

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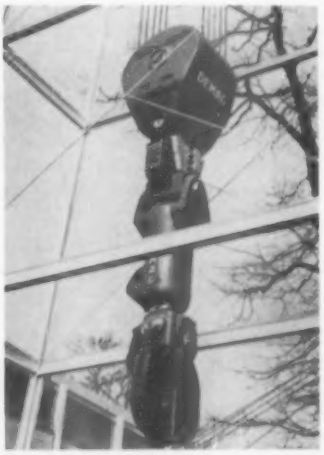


Device Maintains Constant Weight on Rotary Bit

This hoist block includes a device which maintains constant weight on the bit. The main link between sheave and hook is equipped with a tensiometer. It consists of an expansion joint with an induction transmitter. When a load is applied to the hook, the expanding joint generates a current. This current actuates a line payout device via an amplifier. This device provides a constant bit pressure during rotary drilling. The induction transmitter also indicates total load on the hook. **For more information write or call: DEMAG Aktiengesellschaft, Duisburg, Germany.**

●

Sapphire Pen Points Serve Strip-Chart Instruments

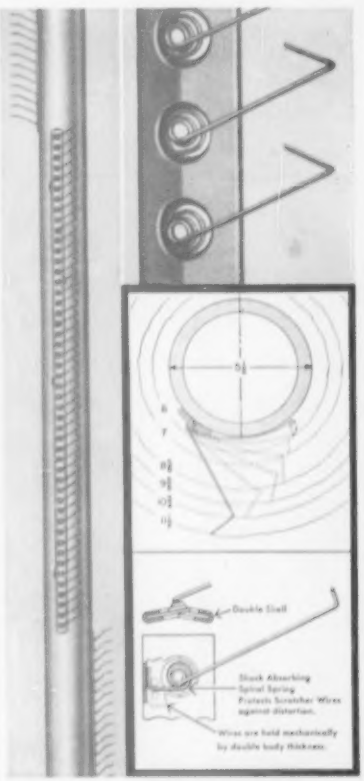
Small, clear synthetic-sapphire pen points serve a line of strip-chart recording instruments. The gems are about the size of a pin head. The jeweled-tip pens not only have an unlimited life expectancy but provide smoother operation. The rounded-gem pen point causes a minimum of abrasive action, thus improving uniformity and quality of the recording. The measurement of heat-treating temperatures as well as flow and power measurements are typical industrial applications for these strip-chart recorders. **For more information write or call: Minneapolis-Honeywell Regulator Co., Wayne & Windrim Avenue, Philadelphia 44, Pa.**

●

Wall-Scratcher Wires Adjust From 6 to 11½-In. Hole Size

This rotating wall scratcher contains wires that always present a scratching point to dig in and remove the mud. The scratcher wires, mounted on 5½-in. casing, scratch the wall of any hole size from 6 to 11½ in. Each wire is formed into a shock-absorbing spiral spring to prevent distortion.

The strong, double-shell scratcher body is readily tack-welded to the casing throughout the area to be cemented.


Double Shell
Shock Absorbing Spiral Spring Protects Scratcher Wires against distortion.
Wires are held mechanically by double body thickness.

Successive scratchers on a given joint of casing should be spaced 120° apart horizontally around the circumference, but mounted end to end vertically, with or without overlap, as desired. **For more information write or call: Baker Oil Tools, Inc., P. O. Box 2274 Terminal Annex, Los Angeles 54, Calif.**

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One good way to lower your lifting costs is to run a Tuff-Temper pump. You can get them in all A.P.I. types, in heavy-duty models for deep wells, and in "stroke-thru" models for gyp and well trash. Leading stores throughout the Mid-Continent area carry Tuff-Temper pumps. Your local store, or our factory representative in your area, will be glad to give you additional details without obligation.

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Removable Bottom-Hole Choke used to prolong the flowing life of a well, is illustrated and described in a two-page information sheet. Including a labeled line drawing, the sheet also includes information on landing nipples and locking assemblies. **For more information write or call: Otis Pressure Control, Inc., 6612 Denton Drive, Dallas, Tex.**

•

Trantex Vinyl Tapes, an eight-page, two-color folder provides information on vinyl tape for pipe wrapping. Utilizing drawings and photographs, the folder illustrates such uses as wrapping on transmission lines, overhead piping, process piping, and service-entry piping. It lists specifications and summarizes special uses. **For more information write or call: Johns-Manville Dutch Brand Division, 7800 South Woodlawn Avenue, Chicago 19, Ill.**

•

Young Shell and Tube Heat Exchangers are covered in the 16-page, 2-color Catalog 1156. It furnishes information on a new line of removable-tube bundle heat exchangers, Type R and RW. The catalog contains design, capacity, and dimension data required for selection and specification of exchangers for hydraulic equipment, diesel engines, gas engines, compressors, and transformers. **For more information write or call: Young Radiator Co., Racine, Wis.**

•

Metex Mist Eliminators is the title of an eight-page booklet. It presents drawings and descriptions of typical installations in evaporators, vacuum flashers, fractionating towers, and knock-out drums. It also includes design and engineering data and specifications. **For more information write or call: Metal Textile Corp., Roselle, N. J.**

•

Macwhyte Safe-Lock Wire-Rope Assemblies are illustrated and described in Catalog 5601. The assemblies consist of a length of preformed wire rope with a

terminal attached to one or both ends. Each end can be a different terminal fitting such as a threaded stud, oval eye, pin eye, clevis, hook, fork, or turnbuckle. **For more information write or call: Macwhyte Co., Kenosha, Wis.**

•

Copper Removal Development Bulletin. A six-page booklet describes a method of removing copper deposits from steam-generating units. A new copper-complexing agent removes the copper at the same time the usual water-formed deposits are removed. The booklet includes data with tables, a photograph of boiler-tube samples, and results of field tests. **For more information write or call: Dowell Incorporated, Box 536, Tulsa, Okla.**

•

National Type E-24 Crank Counterbalanced Pumping Unit is described as having an A.P.I. beam-load rating of 24,000 lb. and peak torque of 228,000 in.-lb. The eight-page Bulletin 462 covers design, construction, and specifications. **For more information write or call: The National Supply Co., 2 Gateway Center, Pittsburgh, Pa.**

•

Paxman Oil-Field Power Units are presented in this six-page, two-color foldout. The package units include seven diesel engines covering outputs from 128 to 800 continuous-shaft horsepower and three gas engines covering outputs from 200 to 533 continuous-shaft horsepower. The folder provides information on package generating sets up to 750 kva. and on-the-job photographs. It contains specifications tables. **For more information write or call: Davey, Paxman & Co., Ltd., Oil-Field Sales, 1 Balfour Place, Mount Street, London, W. 1, England.**

•

Logging, Perforating, Acidizing, and Fracturing Prices are contained in two-color file folder. Separate, tabbed sheets list details and prices for each service including special wire-line work and pumping services. One sheet covers general terms and conditions. **For more information write or call: The Western Co., P. O. Box 310, Midland, Tex.**

•

Physical Properties of Carbide and Carbon Chemicals. This new 24-page 2-color booklet (F-6136) describes 335 organic chemicals. It presents condensed data on applications and gives physical properties in tabular form. It includes an alphabetical index. **For more information write or call: Carbide & Carbon Chemicals Co., 30 East Forty-second Street, New York 17, N. Y.**

•

Brooks Transitwins is the title of Bulletin 170. It describes a pneumatic transmitter and an electric transmitter which are interchangeable. This six-page, two-color foldout includes photographs, cross-section drawings, and flow capacities. These transmitters offer interchangeability which helps in the standardization of flow instruments. **For more information write or call: Brooks Rotameter Co., Lansdale, Pa.**

•

Series 18200 Safeguard Rotameters are covered in Bulletin 18RG. This 12-page, 2-color bulletin details application, construction, operation, and installation of Rotameters. Instructions explain how to select these fluid rate-of-flow meters for liquid and gas service. The bulletin gives data and capacity tables. **For more information write or call: Schutte & Koerting Co., Cornwells Heights, Bucks Co., Pa.**

•

Precision Valves. The new Brochure S-2021R describes a line of valves with illustrations and technical information. **For more information write or call: Circle Seal Products Co., Inc., 2181 East Foothill Boulevard, Pasadena, Calif.**

•

Faster Drilling by a Good Bit. This 12-page, 2-color booklet presents a line of cone bits ranging in size from 3¼ to 7⅞ in. It details tooth design and bearing assemblies. Covering 14 bits, the booklet furnishes sizes, applications, and photographs. It includes mud and air bits. **For more information write or call: Oil Tool Manufacturing Co., Tonkawa, Okla.**

•

Combustible Gas-Detection Equipment is the subject of a new specification sheet describing the Sentinel model and the sample-drawing Sentinel. The Sentinel is a self-contained, portable, audible-alarm unit which, when placed near any hazardous activity, indoors or out, emits a raucous warning if a preset concentration of gas is detected. The sample-drawing Sentinel employs an aspirator bulb and sample hose for exploratory testing from outside a confined danger area. The illustrated specification sheet gives detailed operational and construction data, application suggestions, and prices. **For more information write or call: Johnson-Williams, Inc., P. O. Box 6, Station A, Palo Alto, Calif.**

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EQUIPMENT MEN . . . in the News

Emsco Becomes Division of Youngstown Sheet & Tube

The Youngstown Sheet & Tube Co., Youngstown, Ohio, the principal stockholder of Emsco Manufacturing Co. of Los Angeles, Calif., has purchased all of Emsco's properties, assets and rights under a plan of reorganization approved recently by Emsco stockholders.

Emsco Manufacturing Co. will function as a division of Youngstown Sheet & Tube. The Johnston Pump Co., division of Emsco, will continue its operations as Johnston Pump Co., a division of Youngstown Sheet & Tube.

William T. Powell is president of the Emsco and Johnston Pump divisions.

Wallace to Represent Roots-Connersville

G. M. Wallace & Co. of Denver, Colo., has been appointed field application engineers for all products of Roots-Connersville Blower Division of Dresser Industries, Inc. G. M. Wallace & Co. headquarters are in Denver with offices in Salt Lake City, Utah, and Butte, Mont. The appointment was announced by Vice President D. A. Johann.

Territory assigned to the Wallace company includes Colorado, Wyoming, Montana, Utah, New Mexico, eastern Nevada, southern Idaho and western Texas. The firm is headed by G. M. Wallace who, prior to forming his present company, was assistant sales manager for Bailey Meter Co.

Wallace is assisted in Denver by Jack Phillips, in Salt Lake City by R. E. Kunkel and J. S. Pearson, and in Butte by Paul Le Veaux and J. K. Archibald.

Du Pont Names Ferris as Chicago District Manager

C. W. FERRIS

Carl W. Ferris has been named manager of the newly created Chicago district of the central region of Du Pont's petroleum chemicals division, it has been announced by David H. Conklin, director of sales of the division. The new district, second to be formed in the central region this year, will provide greater service to the oil industry in the Chicago area and will consist of Illinois, Indiana, Missouri and parts of Michigan, Iowa, Kentucky, Tennessee and Wisconsin. The Cleveland district was the first such subdivision to be formed in the central region.

Ferris, who joined Du Pont in 1947, did test work at the company's petroleum laboratory at Deepwater Point, N. J. He was assigned to the central region in 1951 and has been an account manager working out of the Chicago regional office.

BrakeSol Engineers Study Paraffin Control

Treating engineers of BrakeSol, Inc. recently held a meeting in Oklahoma City to exchange ideas and information on new methods of paraffin control. Lester P. Brake told of his recent trip to South America, and Buford Cranford reported on his recent field trip to Mexico.

Seated are: Bill Ramsey, Carmi, Ill.; Cecil C. Blackwell, Houston; Jim Boulden, Casper, Wyo.; Lester P. Brake, president; Ken Bowdon, Odessa; Frenchie Howard, Lovington, N. M.; Standing: Pat Curtin, Oklahoma City; Al Grimsley, New Iberia, La.; Doug Hall, Great Bend, Kans.; Buford Cranford, chief treating engineer, Oklahoma City; Harvey Lowe, general manager, Oklahoma City; Bill Barton, sales-promotion manager, Oklahoma City; Jeff Villines, Ardmore, Okla.; Tom McNaughton, Fort Morgan, Colo. Not shown: Grant Berreth, Calgary, Canada.

Lane-Wells Makes Changes In Mid-Continent Area

Bill D. Lauterbach, sales engineer, has been transferred from Cushing to Perry, Okla., by Lane-Wells Co. Jack D. Cruce has been named district sales manager for Oklahoma and transferred from Wichita, Kans., to Oklahoma City. Thomas G. Bush was transferred from El Dorado, Kans., to Wichita, replacing Cruce.

The Bartlesville, Okla., area was combined with Hominy and Robert D. Johnson transferred from Bartlesville to Hominy as area manager. Bruce J. Grinnel was transferred from Oklahoma City to Casper, Wyo., as district logging engineer, replacing David D. Stedman, who was transferred to Well Surveys, Inc., Tulsa.

Le Roi Names New Manager For Central Sales Region

Stephen C. Berube has been named manager of the central sales region of the Le Roi division, Westinghouse Air Brake Co. Le Roi has its main plant, general offices, and headquarters for the central sales region at Milwaukee, Wis. The region includes Wisconsin, Iowa, and Minnesota, and portions of Illinois, Michigan, Nebraska, South Dakota, and North Dakota.

Berube joined Le Roi in 1953 as a district representative of the company's rock-drill plant. Prior to joining Le Roi, Berube had been a division engineer for Jewell Ridge Coal Corp., and an industrial engineer for Island Creek Coal Co.

Republic's Magnolia Plant To Make Plastic Line Pipe

Equipment for the manufacture of plastic line pipe up to 8 in. in diameter will be installed by Republic Steel Corp. at its plastic products division plant in Magnolia, Ark., it has been announced by L. P. Sharpe, works manager of the division.

Until recently, Republic manufactured all its plastic pipe at the Magnolia plant but recently installed equipment in Cleveland for production of this product to serve northern markets.

Arthur Represents Bechtel In Its New Houston Branch

Bechtel Corp. has opened a new branch office in the Texas National Bank Building, Houston. The office will provide regional headquarters from which Bechtel will serve clients interested in petroleum, petrochemical, natural gas and other industrial expansion.

W. E. Arthur, a vice president of Bechtel International Corp., is Bechtel's Gulf Coast representative. He formerly was concerned with business-development activities in the firm's main offices in San Francisco.

Kobe Elects Slater as Vice President of Sales

W. F. SLATER

W. F. Slater has been elected vice president of sales by the board of directors of Kobe, Inc., Huntington Park, Calif., according to C. J. Coberly, president. Slater joined Kobe in 1940 and since 1948 has been general sales manager of the organization.

Barton Advances Thompson, Appoints George Miller

A. I. Thompson has been promoted from sales manager to vice president in charge of sales for Barton Instrument Corp., Monterey Park, Calif. George Miller has been appointed assistant chief engineer in charge of design and development. Miller formerly was with

A. I. THOMPSON

GEORGE MILLER

Librascope, Inc., in the development engineering department; with Fluor Corp.'s industrial and government project division; and with Askania Regulator Co., Clayton Manufacturing Co., and Shure Brothers.

General Metals Appoints Johnson to Tulsa Sales

Clyde Paul Johnson has been appointed Tulsa district sales representative for the Houston metals division of General Metals Corp. Johnson has been associated with steel and industrial sales for the past 5 years.

The Houston plant of General Metals serves the South and Midwest with drop, upset forgings and castings, produced from carbon, alloy and special materials to customer specifications.

National Supply Opens New Facilities at Great Bend

A new store and warehouse building, which also includes the company's district offices, has been opened by The National Supply Co. at Great Bend, Kans. The building is on a 2-acre lot, which includes a pipe yard and machinery-storage space as well as space for parking. The store has a well-equipped pump shop.

Robert W. Allen is the local store manager. Charles S. Miller is district manager of the Great Bend district. National Supply has had a store in Great Bend since 1950 and moved its district offices there in 1955.

Toledo Pipe Threading Names Sales Manager

C. E. HARTSING

Appointment of C. E. (Cliff) Hartsing as sales manager of the Toledo Pipe Threading Machine Co., Toledo, Ohio, has been announced by P. C. Cooke, president.

Hartsing has been on the Toledo sales staff for 22 years. For the past year, he has been manager of field sales and for 20 years prior to that was located on the Pacific Coast, part of which time he was western sales manager.

Axelson Makes California Promotions, Transfers

H. F. Donley is promoted by Axelson Manufacturing Co.'s petroleum-equipment division to northern California area manager, with headquarters in Taft. Fred J. Graham is promoted to southern California area manager, with headquarters at Long Beach.

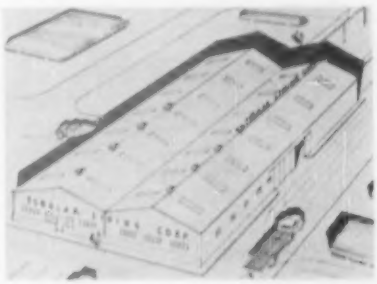
Bardwell E. Alley, district manager at Huntington Beach, is transferred to Taft district in the same capacity. Charles R. Garner is transferred from Orcutt to Ventura district as district manager. Clyde M. Garrison, district service manager at Orcutt is promoted to district manager. Robert L. Tarzian, district service manager at Huntington Beach, is promoted to district manager.

Rolled Steel Corp. Opens Second Skokie Plant

Rolled Steel Corp., Skokie, Ill., a leading supplier of sheet steel to the petroleum industry, has opened a new 56,000-sq.-ft. plant which more than doubles the company's facilities.

Scott F. Burton, vice president in charge of sales, states that the plant is built on the trilevel principle. The office area contains 6,000 sq. ft. and the plant area is 50,000 sq. ft. The plant is equipped with four 7½-ton cranes for handling of steel. Burton said the plant is designed to handle over 48,000 tons per year.

Plastic-Linings Firm Begins Houston Plant

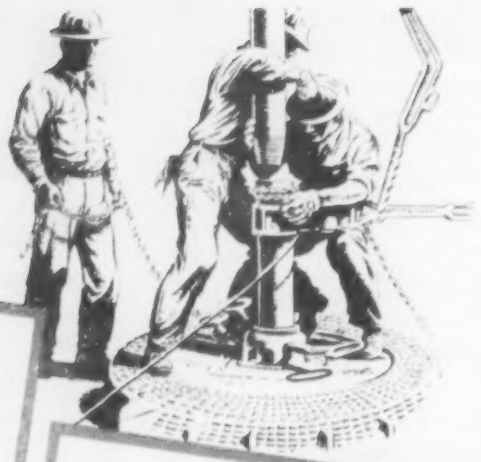


Tubular Lining Corp., a new Houston firm, will specialize in the application of corrosion-resistant plastic linings to the interior of oil-field tubing.

Construction is beginning on a new Houston plant which is being equipped with special machinery to automatically apply linings to 5,000 lineal feet of tubing each working shift. Production is exected to begin about December 20.

The rack yards and facilities will occupy a 10-acre tract on Robin Boulevard. The initial building will cover 13,000 sq. ft.

L. E. Heinen, president and founder of the company, is experienced in the plastics-lining industry. For several years he headed a similar firm, which pioneered in the development and testing of materials and methods.



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Bartlesville, Oklahoma

New England Bids For Number 32

by Frank J. Gardner

Contracts have been signed for four wildcat operations in northwestern Vermont. Operations are based on recent success across the border in Quebec.

WELL, it's happened. Somebody's going to drill for oil in Vermont. Last March 26, this column asked who would be the first to do it. The answer: C. Lewis Stryer, a drilling contractor from Emmaus, Pa. He has signed a contract to drill four wildcats on properties controlled by Maquam Gas & Oil Development Corp., a combine of landowners in Franklin and Grand Isle counties, Vermont.

Stryer's first test should be drilling about the time this appears in print, and the other three will follow in short order. Maquam holds about 10,000 acres in leases, and is signing up more all the time.

A condemned state . . . Now this is all well and good. Never before has anyone seriously considered Vermont as oil or gas country. In fact, Arnold and Kemnitzer, in their monumental work, Petroleum in the United States, spared no words in condemning the state. "The wholly adverse geology of Vermont," they declared, "precludes the possibility of ever finding oil or gas."

But the way Stryer is going about his search may or may not be well and good. He is playing a tenuous trend and a hopeful hunch. Certainly we hope he succeeds. But if he fails, he could give a permanent black eye to Vermont's Lake Champlain basin, site of the current campaign. Geologically, the area is not without promise for oil and gas, but Stryer is ignoring the pleas of State Geologist Charles Doll for a more scientific study before drilling. "This is not wildcatting," the driller says. "There is no need for surveys. These fields are already semiproven. We know there is gas in the Champlain basin."

The driller bases his belief on the recent small gas strike across the Canadian border in the St. Lawrence Lowlands of Quebec. Geologist Doll also believes there are possibilities of production, but he contends that a scientific search via geological and geophysical surveys will speed discovery. History says that he's right. But history also records some momentous discoveries by hunch-driven wildcatters who disdained the geologist.

Needs Lady Luck . . . So these operations will be interesting to watch. An impulsive driller locks horns with a scholarly scientist. And the only referee will be Lady Luck.

If he hits, Stryer will add the thirty-second producing state to the list. He will bring a new era of industry to a gas-hungry region. He might set a price record for natural gas, for he expects to get 60 cents per M.c.f. at the wellhead; in nearby Montreal, he points out, the purchasing price is 70 cents and the selling price $1.05. He might strike oil, and if he does, it will set the St. Lawrence country afire with drilling.

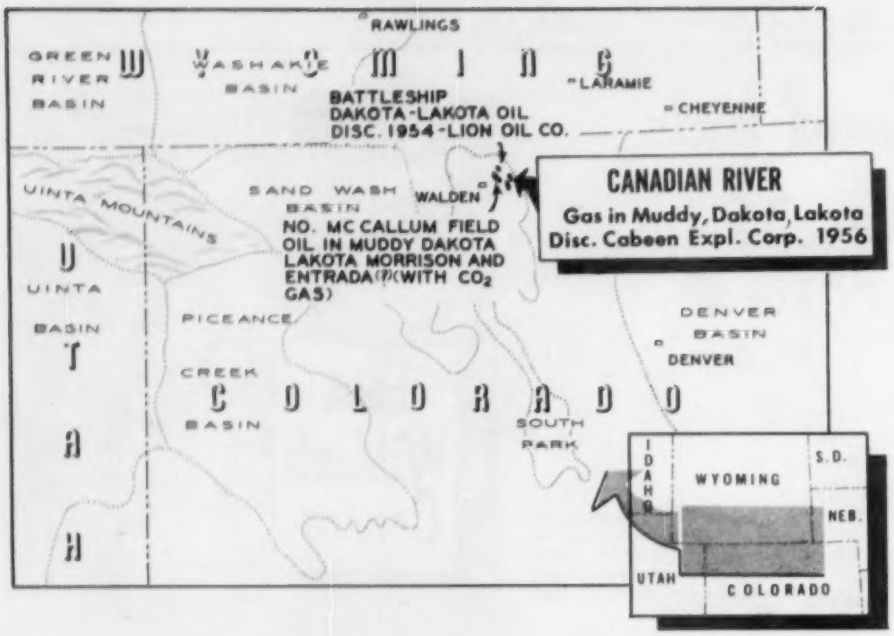
But if he misses, he could delay further search in the Lake Champlain basin for years. Four dry holes in a small basin are enough to frighten away future oil finders, despite their random locations. It's too bad that he and the good Professor Doll can't get together, for whether it's a hit or a miss, the geologist stands to lose . . . a peculiar situation for the profession. A hit would cause Vermonters to look askance at the rockhound who had discouraged drilling; a miss will kill financial interest in the basin and discourage future drilling on a scientifically located structures.

To join the list . . . What are the chances, really? Not too bad, not too good. Just mediocre. Geologists who have studied the area point to a U-shaped basin extending 15 to 20 miles into Vermont from its northern border, and enclosing Lake Champlain. It's a marine sedimentary basin, with the chief drilling targets being Cambrian and Ordovician rocks with a total thickness up to 8,000 ft. Numerous water wells near St. Albans, Vt., have active gas seepages. There is a great deal of deformation and structures should be plentiful. They could logically hold oil and gas pools. Exploration to the north has produced commercial gas wells near St. Jean. One, in recent months, and it is entirely conceivable that Vermont can join the producing list.

Hit or miss, the drilling campaign will accomplish one thing. It will bring home to a large group of New Englanders the true story of oil. They'll discover that all oil men are not millionaires; they'll discover the hazards and the risks for themselves; they'll discover the realities of the competitive search; and they'll discover the truth about the depletion allowance.

Vermonters don't excite easily. But they're excited about this. One enthusiast, unable to contain himself at a recent citizens' meeting, shouted, "We'll be buying Cadillacs and mink coats for Christmas."

Well-l-l, maybe.



CANADIAN RIVER lies on the northeast flank of the North Park, an intermontane basin some 70 miles northwest of Denver. Fig. 1.

by
A. Saterdal
and
Craig R. Norton

When intermontane basin interest began to lag . . .

Along Came Canadian River

CANADIAN RIVER FIELD is of more than usual interest because of shallow depths, very favorable reservoir characteristics, and its position in a little-explored 8,000-ft. high, Rocky Mountain intermontane basin.

The discovery well, Cabeen Exploration Corp. A-1 Blevins, SW NE NW 11-19n-78w, Jackson County, Colorado, was spudded March 9, 1956, during blizzard conditions. Although the unusually severe weather gradually became less of a problem, the drilling of this well was never tranquil. A few serious problems arose.

Two hundred and seventeen feet of 8⅝-in. surface pipe was set March 12 in weather that reached 42° below zero. For a few days drilling was relatively uneventful with exception of the sticking of drill pipe in the Niobrara shale at 275 ft. The formation was probably ruptured at this point in an attempt to loosen the pipe with pump pressure. Such a problem is not uncommon in the Niobrara in this area and would have gone unnoticed except for later events. On March 20 at a depth of 1,496 ft. the well blew out upon encountering a gas sand in the Muddy zone. An accurate gage of the gas volume was never obtained but at most it was probably a 2½-M.M.c.f.d. rate.

The flow was controlled with some difficulty and in doing so the zone of original rupturing at 275 ft. was probably further fractured.

Coring ahead was continued with 11.8-lb. per gal. mud and indicated a total of 30 ft. of net sand in the Muddy. Drill-stem-test gages indicated approximately a 6-M.M.c.f.d. rate. Average porosities are 23 per cent and permeabilities are 180 md. with streaks up to 400 md. Bottom-hole pressure ranged up to 735 psi.

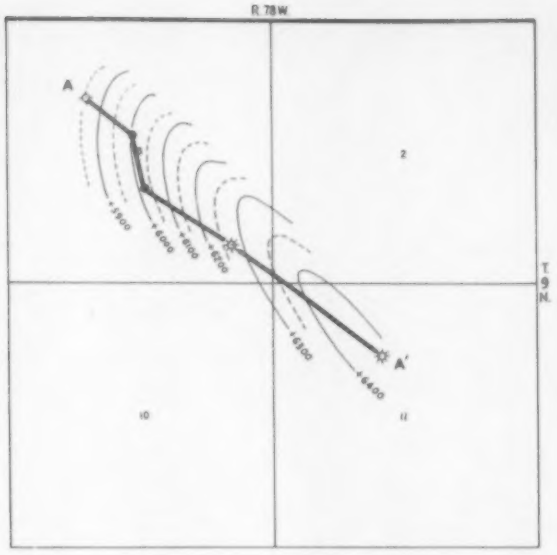
A second blowout occurred at 1,593 ft. on March 28 and when the blowout preventer was closed gas channeled to the surface about 200 ft. from the rig, presumably through the ruptured zone at 275 ft. Almost immediately several hundred "geysers" were noted; in some of these gas, mud, and oil blew in the air up to 12 ft. above the ground. Fortunately the blowout area, which covered 8½ acres, was downwind from the rig. The blowout preventer was opened at this time and a gas volume estimated at between 10 and 20 M.M.c.f.d. was allowed to blow through a 2 and a 3-in. line.

The well was finally killed on March 30 with 20 lb. per gal. mud. Rather than risk another blowout under these conditions, the 3½-in. drill pipe was cemented in the hole. Perforations were made with four jets per foot at 1,533-1,485 ft. through drill pipe and drill collars. A gage of 2½ M.M.c.f.d. was recorded indicating either that the heavy mud had done considerable damage to the well or that the perforating through the drill pipe and heavy drill collars was only partially successful.

Subsequent drill has indicated a substantial gas reserve in the Muddy, Dakota, and Lakota sands as well as oil rings in the Dakota and Lakota, and possibly in the Muddy. Oil in the Lakota is 21°-gravity sweet crude, brownish-green in color.

Prediscovery exploration history . . . Development of petroleum reserves in the North Park basin of Colorado, as well as in the Middle and South Park basins, has been retarded by the presence of troublesome carbon dioxide gas which is produced along with high-gravity distillate at North McCallum field 3 miles west of Canadian River. Recent developments have been more favorable. Lion Oil Co. discovered Battleship field in 1954, 5 miles north of Canadian River with 32°-gravity oil in the Dakota-Lakota section. Also the USGS has allowed blowing off of the CO_2 gas at

The authors are, respectively, division geologist and chief petroleum engineer, Wm. Ross Cabeen & Associates, Denver.



PRELIMINARY map of Canadian River shows a northwest-plunging anticlinal nose. Subsequent drilling will probably define a sharply folded anticline with a fault along the northeast limb. Fig. 2.

North McCallum instead of costly repressuring of this reservoir which is now conceded to have an active water drive.

The Blevins lease on which all wells have been located to date at Canadian River was acquired by Cabeen Exploration on an exploration option basis from Continental Oil Co., which retains a one-half interest.

Photos the tipoff . . . The initial geologic exploration which led to the discovery of Canadian River field was accomplished through detailed examination of aerial photographs. When this information was coordinated with published geologic information, it became apparent that one or more additional major structures would be necessary to fill the gap between the syncline east of the McCallum trend and the edge of the basin 4 miles northeast. The study of the aerial photos indicated a very specific target for subsequent seismic evaluation, however, and deserves most of the credit for the discovery. A total of 21 holes were shot under contract with Southern Geophysical Co., Fort Worth, in evaluating the photo lead. Two recording trucks were used to get full-spread crosscontrol at each shot point. An additional four holes were shot through the proposed drill site in this critical part of the structure after marshy meadows had frozen sufficiently to bear the weight of the equipment. This confirmation work was done under contract with Tower Exploration Co., Denver, using a split spread of 16 in-line traces and 8 crosstraces.

Record quality was good in both cases although dips are generally steep and the structure is fairly complicated. Because the structural axis migrates with depth, the initial well might have been a dry hole if the seismic work had not been done.

Drilling to date has indicated that the prediscovery structural picture is essentially correct.

Structure . . . Control for the accumulation in Canadian River field is essentially an anticlinal structure (Fig. 2). Substantial reverse faulting was indicated on the northeast side of the field during exploration work, but this has not been proved by drilling to date. Some faulting within the presently drilled area can be found by careful examination of the logs. Average plunge to the northwest is 6° while dips on the southwest flank may be as high as 30°. Additional structural complications are likely but not completely understood at present.

Stratigraphy and Reservoir Characteristics

Muddy . . . To date, gas production in the Muddy sand has been established in two benches and only on the top of the structure. Net sand in the two benches averages 30 ft. The gas is nearly pure methane. Porosities average 23 per cent and permeabilities average 180 md. with streaks up to 400 md. Only one well is productive to date. A ½-mile northwest offset (135 ft. low structurally) tested fresh water although the sand was oil saturated. An as yet untested oil ring is suspected in the Muddy. This will probably be narrow. Bottom-hole shut-in pressure is 725 psi. and a strong water drive is indicated.

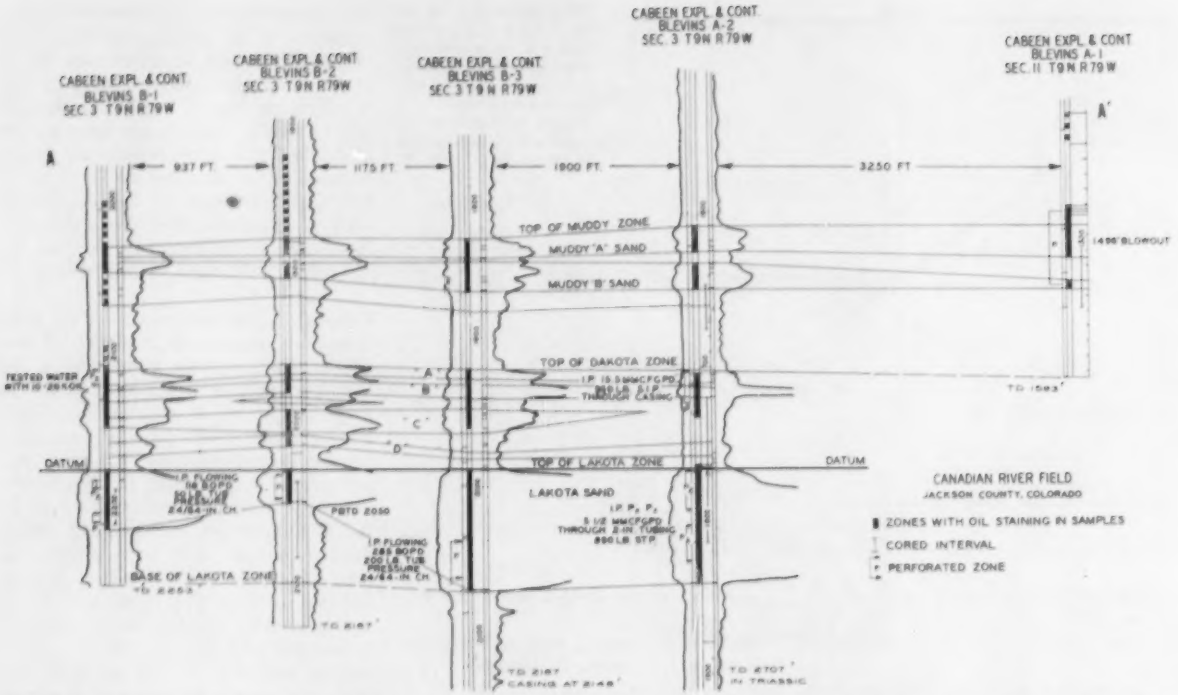
Dakota . . . New-pay discovery well in the Dakota was the A-2 Blevins. The gross Dakota section is 55 ft. in thickness with an average net sand from MicroLog and cores of 20 ft. Porosities and permeabilities are excellent as is indicated by the initial potential of 15.5 M.M.c.f.d. from a completion in 12 ft. of net Dakota sand. This gage was obtained in the A-2 Blevins through 8⅝-in. casing with the perforated zone at 1,704-1,724 ft. A narrow oil ring is anticipated in the Dakota as free oil has been recovered on some drill-stem tests in wells downdip from the A-2. Four separate Dakota sand benches are traceable in the wells drilled to date.

Lakota . . . The Lakota sand is the most important reservoir in the field. In two of the four sections penetrated a net sand thickness of nearly 80 ft. has been logged. The upper part is fine-to-medium-grained sand and the lower part usually a conglomerate. The most impressive well completed to date is the B-3 Blevins which penetrated 10 to 20 ft. of Lakota gas cap beneath which there is at least 60 ft. of water-free oil sand. The well was completed flowing 285 bbl. of oil per day through a 16/64-in. choke with 200-psi. tubing pressure at a depth of 2,031 ft. Lakota porosities are excellent, ranging up to 27 per cent, and permeabilities are generally high, ranging up to 1,500 md. It is indicated that the oil ring will be fairly narrow.

The Lakota was first found to be productive of gas in the A-2 Blevins. The A-2 is a ½-mile northwest stepout along the axis from the A-1, discovery well in the field from the Muddy. A second ½-mile stepout in the same direction (B-1 Blevins) resulted in a "near-miss" dry hole. On the top of the Dakota the B-1 was over 550 ft. lower structurally than the highest well in the field and was 435 ft. lower than the nearest updip well (A-2 Blevins). In the B-1 Lakota cores were saturated with oil but heavily fractured and tested very slightly oil and gas-cut water. Dakota was perforated and swabbed 10-20 per cent oil with water. Subsequently the B-2 Blevins was drilled and found the Dakota 160 ft. higher than the B-1 and carrying oil and gas. The Lakota tested clean oil and was completed for an initial potential of 118 bbl. of oil per day on 24/64-in. choke with 50-psi. tubing pressure. One additional Lakota well (B-3 Blevins) has been completed as a 40-acre extension for 285 bbl. of oil per day from 60 ft. of net Lakota oil sand.

Development Drilling

Development drilling in Canadian River field presents few problems. The only drilling difficulty incurred is some crooked-hole trouble, but this can be readily corrected by using less weight on the bit and reducing the number of drill collars. The wells are drilled from top to bottom using relatively long-



THE LAKOTA SAND is the most important reservoir in the field, yielding both oil and gas. The Muddy and Dakota produce gas; geologists and engineers suspect that both these sands may have a narrow oil ring that will eventually produce. Fig. 3.

tooth tricone bits. The penetration rate averages approximately 300 ft. per day and this could be greater were it not for the drift problem.

Drilling fluid must be weighted to approximately 12.5 lb. per gal. to control the abnormally high formation pressures. Success with gel lignite and caustic type of mud has been very good. During completion of a trip with the drill pipe the tools can be run to bottom without reaming or the need for washing out fill. Viscosities range from 60 to 80 seconds by Marsh funnel; water loss approximates 5 cc. in 30 minutes while drilling above the pay and less than 3 cc. in the pay.

The altitude of 8,000 ft. and weighted mud make flooded suctions on pumps very important to arrive at effective drilling pump pressures. Mud pans, or tanks, and standby pump allow for efficient mud handling during mixing and degassing operations.

Butane-propane fuel is supplemented with natural gas from nearby wells to reduce costs and still produce power at the relatively high elevation.

In the warmer months weighted mud has been stored during the interval between drilling successive wells, but this practice must be discontinued during the winter due to the severe cold (subzero temperatures).

Costs and completions . . . Operating and drilling costs in the Rocky Mountains are relatively high when compared with some of the other oil-producing areas in the United States. At the present stage of development at Canadian River, a field well costs approximately $37,000 to drill and equip for producing. Of this, the drilling fluid bill averages $3,000.

We have found the following completion program to be successful and especially economical to perform:

The wells are drilled to approximately 80 ft. below the base of the pay. Five and one-half-inch casing, equipped with a float collar and float shoe, centralizers and scratchers, is run to bottom. The casing is worked continuously during the mixing and displacing of the cement. The regular cement is mixed with 1 per cent calcium chloride and as soon as the plug is down the pressure is released and the casing landed. Tubing is picked up and run to bottom, then stood in the derrick. A radioactive log is run and the well perforated approximately 18 hours after the casing has been cemented. The tubing is then run equipped with a packer. The drilling fluid is displaced from the tubing with water after which the packer is set. The well is then acidized with mud acid and allowed to flow and clean up on a choke no greater than 24/64-in.

Future Activity in North Park Basin

Substantial economic oil and gas reserves are indicated at Canadian River, particularly where development costs are related to possible reserves.

There is insufficient production history to determine how the oil wells will produce. Although pressures are expected to remain high due to a strong water drive, the size and configuration of the oil ring are not sufficiently understood to accurately predict ultimate reserves.

It is believed inevitable that an important wildcat drilling play will be maintained in the North Park basin as a result of discovery of Battleship and Canadian River fields during the past 2 years. This should contrast sharply with the preceding period of nearly 20 years during which time practically no purely exploration drilling was done in North Park. A very high frequency of oil shows and structural relief, coupled with an excellent reservoir section in the Muddy, Dakota, Lakota, Morrison, and Entrada (?), make this basin extremely attractive.

If there is a single serious problem confronting the geologist working this basin, it is probably the difficulty in resolving the correct structural picture. For this purpose it is suggested that extremely detailed seismic work be done prior to drilling. Photo and surface geology will be very valuable in focusing on favorable areas for such seismic work and should reduce the cost of finding a drillable prospect considerably.

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EXPLORATION HIGHLIGHTS

MID-CONTINENT

KANSAS

Edwards County Adds New Gas Producer

A new gas field was opened in Edwards County at Sunray Mid-Continent Oil Co. 1 King in NE NE SW 33-26s-16w, 1½ miles south of Truesdale pool in the southeastern part of the county.

The discovery, separated from Truesdale pool by a dry hole, gaged 6,000 M.c.f. of gas per day from 4,472-92 ft. in the Cherokee-Pennsylvanian sand.

Flowing Oil Strike Finaled in Pratt

A flowing oil discovery was completed in Pratt County. The discovery well is Osage Oil & Gas Co. 1 Cochran estate in NE NE SW 10-27s-15w, 3½ miles southeast of Tatlock pool and 5 miles northwest of Cullison, Kansas, in the western part of the county.

The Mississippian discovery flowed 131 bbl. of oil per day on state test from perforations at 4,438-47 ft.

HUGOTON EMBAYMENT

SOUTHWEST KANSAS

Testing Due at Morton Confirmation

The confirmation well to a new gas area in northern Morton County, extreme southwestern Kansas, is due testing by Panhandle Eastern Pipe Line Co. The 1-35 Going, C NE 35-32s-41w, just southeast of Richfield, will undergo tests in the Keyes-basal Pennsylvanian sand.

This offset try is the confirmation to the 1-26 Going discovery in 26-32s-41w, which was completed flowing 13,350 M.c.f. of gas per day from the Keyes sand at 5,192-5,222 ft. The confirmation well flowed 4,070 M.c.f. of gas per day on test at 5,195-5,224 ft.

Meade County Gas Discovery Completed

Monsanto Chemical Co. completed its 1 Marion gas discovery in Center Lot 2, 14-35s-27w, 6 miles southwest of McKinney gas pool in southern Meade County, flowing 4,890 M.c.f. of gas per day from perforations in the Mississippian at 6,275-6,307 ft. Location of the new pool is just north of the Oklahoma state line.

APPALACHIAN

OHIO

An east extension to Mt. Zion pool in Jackson Township, Knox County resulted in one of its best wells. Preston Oil 2 Carl Harris, Section 19 showed 6 bbl. natural from Clinton at 2,913-67 ft. and 395 bbl. in 24 hours after fracture.

● In Marne pool in Madison Township, Licking County, two wells of importance were completed. Jebb Oil & Gas 2 United States, Lot 6, filled up

Exploration this week

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THE OIL AND GAS JOURNAL

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1,200 ft. with oil and gaged 300,000 cu. ft. gas natural and made 400 bbl. and 600,000 cu. ft. after fracture. Clinton sand was logged at 2,578-2,614 ft. Waverly Oil Works 2 Giffin, Lot 6, was completed natural in the Newburg sand with a gage of 1,650,000 cu. ft. The sand was topped at 2,075 ft. and drilled to 2,095 ft.

PENNSYLVANIA

In Armstrong Township, Indiana County, Southwest Pennsylvania, Peoples Natural Gas Co. 4107 E. Carney, wildcat completed in the Oriskany sand gaging 2,500,000 cu. ft., gas, Tully 6,878 ft., Onondaga 7,428 ft., Chert 7,445 ft., Oriskany 7,562-82 ft., TD 7,585 ft.

● In Young Township, New York State Natural Gas Corp. N-514 Florence Bodin, has gas in this formation testing 850,000 cu. ft., and is shut down at 7,520 ft. T. W. Phillips Gas & Oil Co. 3 Fee (Neal surface) is shut down at 7,415 ft., rigging up spudder. The Onondaga, was recorded at 7,398 ft.

WEST VIRGINIA

In Licking district, Tucker County, West Virginia, Hope Natural Gas Co. 10012 T. A. Loughrey, elevation 1,714 ft., encountered gas at a depth of 4,150-4,159 ft., testing 2,214,000 cu. ft., which blew down to 1,716,000 cu. ft. Drilling is at 4,219 ft.

● Plymouth district, Mercer County, Bluefield Gas Co. 1-100 Dee & Lola Bailey, is drilling at 790 ft.

EASTERN KENTUCKY

On Left Fork of Elkhorn Creek and northeast of the town of Sizerock in Leslie County, United Fuel Gas Co. is drilling at 200 ft. on a projected Knox dolomite (Cambro - Ordovician) test. This will be the first test of these formations in the entire county. Test is being supported by other leasehold interests in the area.

GREAT LAKES

MICHIGAN

A Dundee-Reed City zone oil well was under test in the Reynolds field, Montcalm County, at the William Cline 1 Nicholson, SE SE SE 6-12n-9w, Winfield Township. This new well is the south 40-acre offset to a producing well and the east 40-acre offset to a dry hole in this same pay objective. Structurally, the 1 Nicholson was about 10 ft. lower on porosity zone than either the dry hole or the north producer.

Dundee top at this surprise well was logged at 3,257 ft. Hole was bottomed

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out at 3,364 ft. Well has been flowing an average of 20 bbl. of oil a day natural. More gas was showing from pay zone at this well than from any other producer in the pool. On Dundee top, 1 Nicholson was only 4 ft. lower structurally than offsetting producer and failure.

● The fourth Salina gas producer appeared assured in Overisel pool, Allegan County, at The Taggart Co. 1 Peters-Kroeze, C SW 9-4n-14w. When this new producer is completed, this field will be over a mile long on a diagonal northwest - southeast strike. Wells are drilled on an 160-acre spacing pattern.

While new well has not been drilled in, gas was in evidence before long string of 5-in. casing was set with rotary tools at 2,595 ft. Hole will be cleaned out and deepened further in Salina dolomite pay with cable tools.

Taggart moved rotary to the C NE 21-4n-14w, for the next start in the pool.

This gas development in Overisel is the most successful deeper pay development (below Traverse lime famous for oil production in the area) in Southwest Michigan.

Taggart is expected to announce plans to build a gathering line in the area as soon as outline of gas pool, and its reserve, becomes large enough to warrant it.

PACIFIC COAST

CALIFORNIA

Union Seeks Vedder At Mountain View

Union Oil Co. of California has decided to drill through the recently discovered Derby sand for a look at the Vedder with its first offset to 1 Stenderup, the Derby discovery well in the Mountain View field, Kern County.

This offset, 64-21 Cattani, NW NE 21-31s-29e, was drilling ahead below 9,875 ft. The discovery well has been choked back to 200 bbl. daily production from an initial flowing rate of 1,170 bbl. daily.

Union Tests Bardsdale Offset

Union Oil Co. was testing 2 Irwin Berylwood, the first offset to its Pliocene discovery well on the west flank of the Bardsdale field in Ventura County. This well is located 30 ft. southwest of the discovery which was drilled under the Oakridge Fault to find Pliocene production at depths greater than Miocene and Eocene pool found above the fault. Present depth of this offset was 5,717 ft.

Signal Nears Time For Decision at RB

Signal Oil & Gas Co. was nearing completion of its fifth well being slant-drilled under the Pacific Ocean from an onshore site at Redondo Beach in Los Angeles County. Under terms of the lease with the city, Signal, as operator for itself and two other oil companies, will drill one more well from this onshore site and then must either cease drilling operations or build an artificial island out in the bay for further drilling. The latest test, 5 Redondo Beach, was at 5,535 ft.

ROCKY MOUNTAIN

MONTANA

Casing Set at Rank Sheridan Prospect

Amerada has set casing to 9,950 ft., total depth, at its apparent Sheridan County Silurian discovery in northeastern Montana. The 1 Tange, a rank wildcat in C NE SE 20-36n-53e, flowed oil on drill-stem test at 9,050-9,230 ft.

This advertisement appears as a matter of record only. No public offering is being made of these notes.

$8,500,000

Home Oil Company Limited

5½% Secured Notes due 1971

(with transferable stock purchase warrants)

Under a Purchase Agreement, negotiated through the undersigned, $6,050,000 of the above-mentioned Notes have been sold privately, and the balance of the Notes will be sold on or prior to December 31, 1956.

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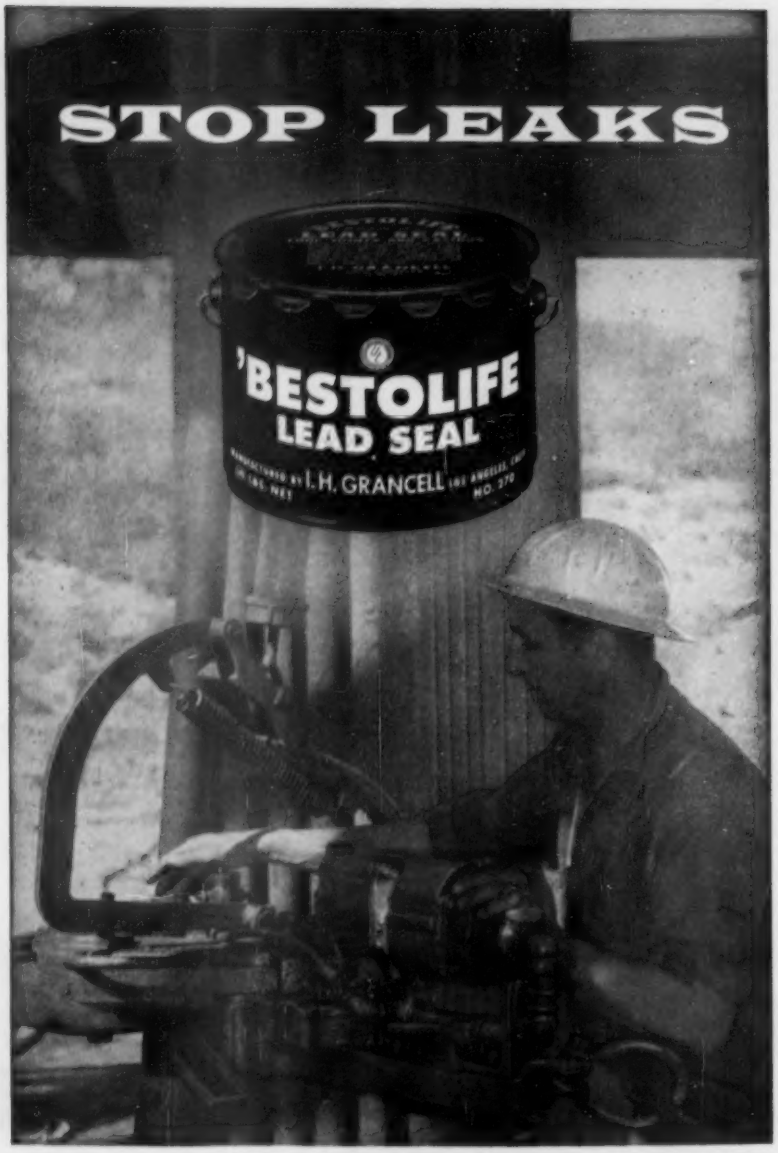

It is not easy to keep casing and tubing from leaking, especially in deep, high-pressure wells. The high percentage of metallic lead in 'Bestolife Lead Seal actually provides a plastic lead gasket for threads as joints are made up. That's why joints made up with 'Bestolife won't leak, strongly resist corrosion, and can easily be broken out—even years later. Your local supply store stocks 'Bestolife in 1¼, 5, 20 and 50 lb. cans. Unconditionally guaranteed.

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Amerada Petroleum Corp. has apparently moved Montana production to its northeasternmost point at 1 Tange, C NE SE 20-36n-53e, Outlook area, Sheridan County. Recovery on a drill-stem test in the Silurian at 9,055-9,160 ft. was 1,000 ft. water cushion in 35 minutes. Flow was at the estimated rate of 20 bbl. fluid per hour at the end of 2 hours. At the end of the 5-hour test the flow was about 100 per cent oil, having been 70 per cent at first. This important discovery prospect is 29 miles northeast of nearest Montana production at Northeast Bredette field in Daniels County. Success at Outlook would open first production in Sheridan County.

UTAH

Oil Flows at West Aneth Field Stepout

Three States Natural Gas Co. 1 Federal-Arrowhead, W½ NE NE 14-40s-23e, San Juan County, about 1 mile west of Aneth field's producing area and 3 miles northeast of Recapture Creek, flowed oil at the rate of 10 bbl. per hour on drill-stem test in the Paradox at 5,627-5,700 ft. The operator has run pipe. The apparent discovery is in an area on no previous tests.

Superior Will Drill Southeast of Aneth

Location was announced for the 1 Navajo C in NW SW SW 32-40s-25e, San Juan County, a Superior Oil Co. wildcat 3 miles southeast of The Texas Co.'s 4 Navajo-C discovery. This test will be an important one southeast of the main Aneth trend. The Texas Co.'s 4 Navajo-C well flowed 642 bbl. of oil per day on 1-in. choke from the upper Hermosa.

Coring Under Way At Gulf Discovery

Gulf Oil Corp. is coring below 5,805 ft. at its 1 Indian discovery, 3¾ miles southwest of Recapture Creek in the

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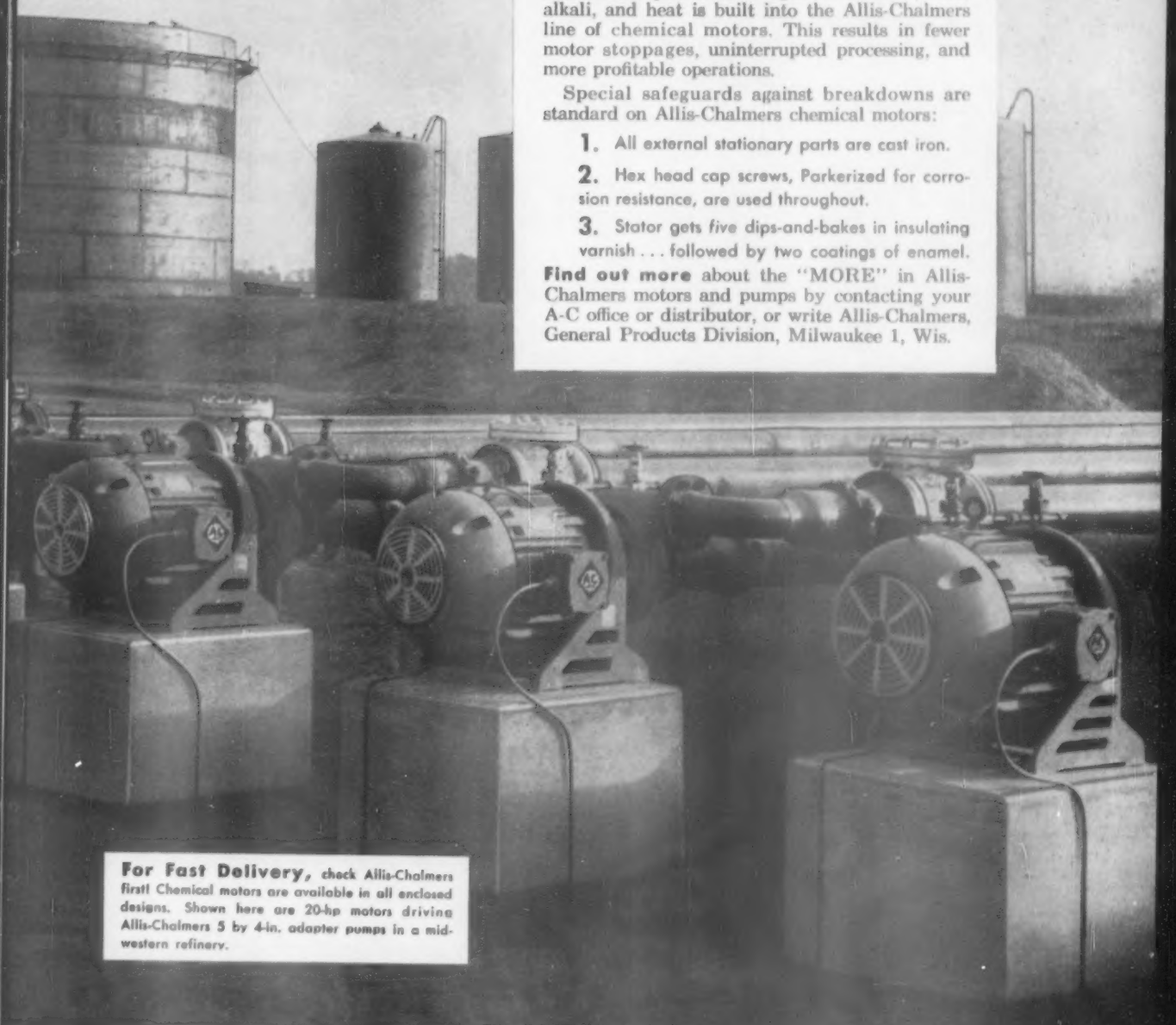

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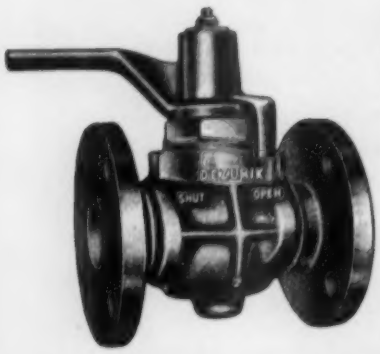

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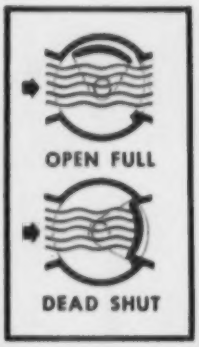

DeZurik Valves are manufactured in sizes from ½" thru 20"; in all metals; in lever, gear, pneumatic, hydraulic and electric operated models.

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Representatives in all principal cities.

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Aneth area, San Juan County. The well earlier flowed 55 bbl. of oil in 3 hours on test at 5,753-5,804 ft.

COLORADO

Gas Discovery Finaled In Moffat County

Moffat County in northwestern Colorado has a new gas pool discovery well at U. S. Smelting, Mining & Refining Co. 1 Government-Winder, SW NE NE 33-8n-90w.

The well was completed open flow for 14,000 M.c.f. per day from perforations in the Lance at 2,978-3,008 ft. Location is 8 miles northeast of Craig, Colo. Closest production is at Lay Creek field, a Wasatch producer 10 miles northwest.

NORTH DAKOTA

Deep Test Continues Drilling in Beaver Lodge

Amerada Petroleum Corp.'s deep test inside Beaver Lodge field, Williams County, is coring below 11,458 ft. in the Silurian. The 1 Iverson-Nelson, NW SE NW 2-155n-96w, will go to the Winnipeg at about 13,500 ft.

Two weeks ago this wildcat had good oil shows in the Duperow-Devonian at 10,279-10,483 ft. on cores. There was odor, fluorescence, and cut locally in the Dawson Bay lime and dolomite.

Testing Continues at Bottineau Prospect

Testing continues at North Central Oil Co.'s indicated discovery on Williston's eastside Bottineau County. The 1 Pearson, NW NW 36-163n-83w, recovered 400 ft. of free oil and 100 ft. of heavily oil and gas-cut mud on drill-stem test at 4,005-21 ft. This wildcat is 13 miles southwest of Kuroki field, nearest production.

WYOMING

New Pays Tested at Whistle Creek Field

The Muddy and Morrison are apparent new pay discoveries in Whistle Creek field, Park County, Big Horn basin. Seaboard Oil Co. tested gas at the rate of 2,960 M.c.f. per day at its 45-16-T well in SE NW SE 16-56n-98w. The operator will also test the Morrison for its oil potential.

• A deep wildcat in the Blue Mesa area of Washakie County was abandoned by Phillips Petroleum Co. at 14,460 ft. This well was first a Tensleep test to 13,000 ft., but went on to the Madison for a drill-stem test at 14,375-14,460 ft. Only mud and sulfur water were recovered and no shows found. Phillips then went back to the Tensleep for tests at 13,773-13,863 ft., but were not successful.

EASTERN INTERIOR

WESTERN KENTUCKY

One of the busiest new producing areas in the Tri-State region is in Henderson County. Slagter Producing Co. opened the 1 King heirs, Waltersburg sand area last spring with production at 1,749-52 ft. The discovery well was completed for 24 bbl. per day. Since May four additional wells have been completed with gages up to 250 bbl. daily. Other companies working in the area are Carter Oil Co., Ryan Oil Co., and Phillips Petroleum Co.

• In Christian County Marhill Oil & Gas Co. and Basin Drilling Co. have a new-pay discovery at their 10 Dr. G. L. Simpson in 17-H-27, 2 miles east of Apex. The discovery well made 75 bbl. of oil per day, natural, from the Rosiclare at 909-16 ft.

ILLINOIS

In Edwards County, 4 miles southwest of Albion, Calvert Drilling Co. is testing in the Aux Vases at 3,180-98 ft. at 1 Noel Everett, SW SE NE 29-2s-10e. Recovery on a 2-hour test at 3,173-96 ft. was 1,020 ft. of gas and 62 ft. of oil-mixed mud.

INDIANA

In Gibson County, 4 miles southwest of Princeton, John Buchman, et al., have set casing to test the Benoist at 2,201-06 ft. at their 1 J. C. Reed in SE NE SW 28-2s-11w, a stepout test. A drill-stem test recovered 900 ft. of gas, 55 ft. muddy oil. Pressure was 578 psi.

SOUTH TEXAS

TEXAS GULF COAST

Aransas Pass Area Reveals Further Oil Potentialities

Potentialities of the Aransas Pass area of coastal San Patricio and Aransas counties for additional exploration are revealed further by another good oil discovery 3 miles south of the townsite, and about 4 miles south of the main Aransas Pass field.

Discovery well is Arkansas Fuel Oil Corp.'s 1 Brewster-Bee Unit, in San Patricio County, drilled to 9,055 ft., and completed in a 7,600-ft. Frio sand,

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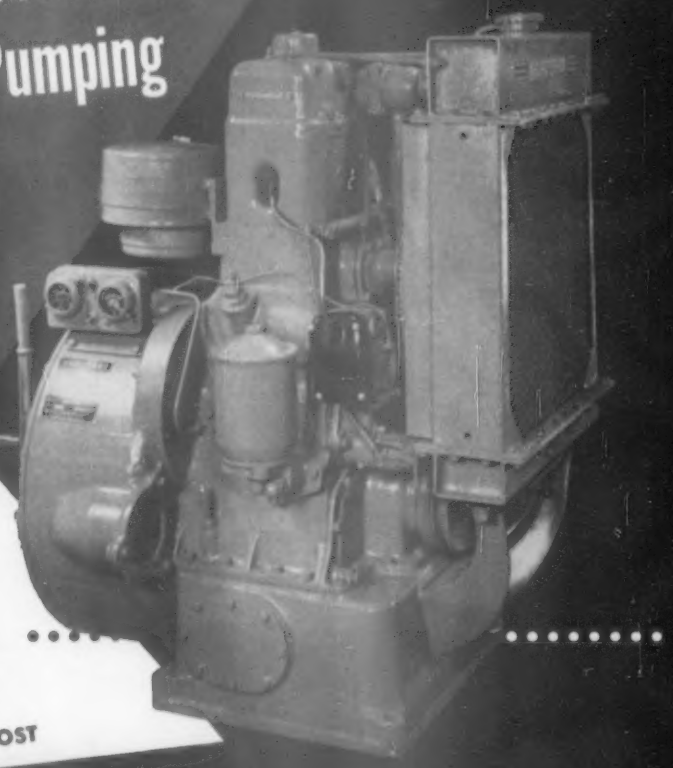

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RINGED black circle (center of map) is location of Arkansas Fuel's oil-discovery well southwest of Aransas Pass (at southeast edge of Aransas Pass field).

perforated at 7,675-78 ft. During its potential gage, taken through 9/64-in. choke, it flowed at the rate of 165.6 bbl. of 39.9°-gravity oil per day. Flow was with gas-oil ratio of 888 cu. ft. per barrel, and pressure of 1,140 psi.

Location is 4 miles west of a workover, wildcat oil-producer completed last September by Aransas Dock & Channel Co. on Stedman Island, in Red Fish Bay, 2½ miles southeast of Aransas Pass. Productive interval of this well is 7,596-7,612 ft. About 1½ miles north of the latter well, and about the same distance east of Aransas Pass, a gas-condensate discovery-well was completed last February with pay at 8,200 ft.

Gas Production Tested In Matagorda Wildcat

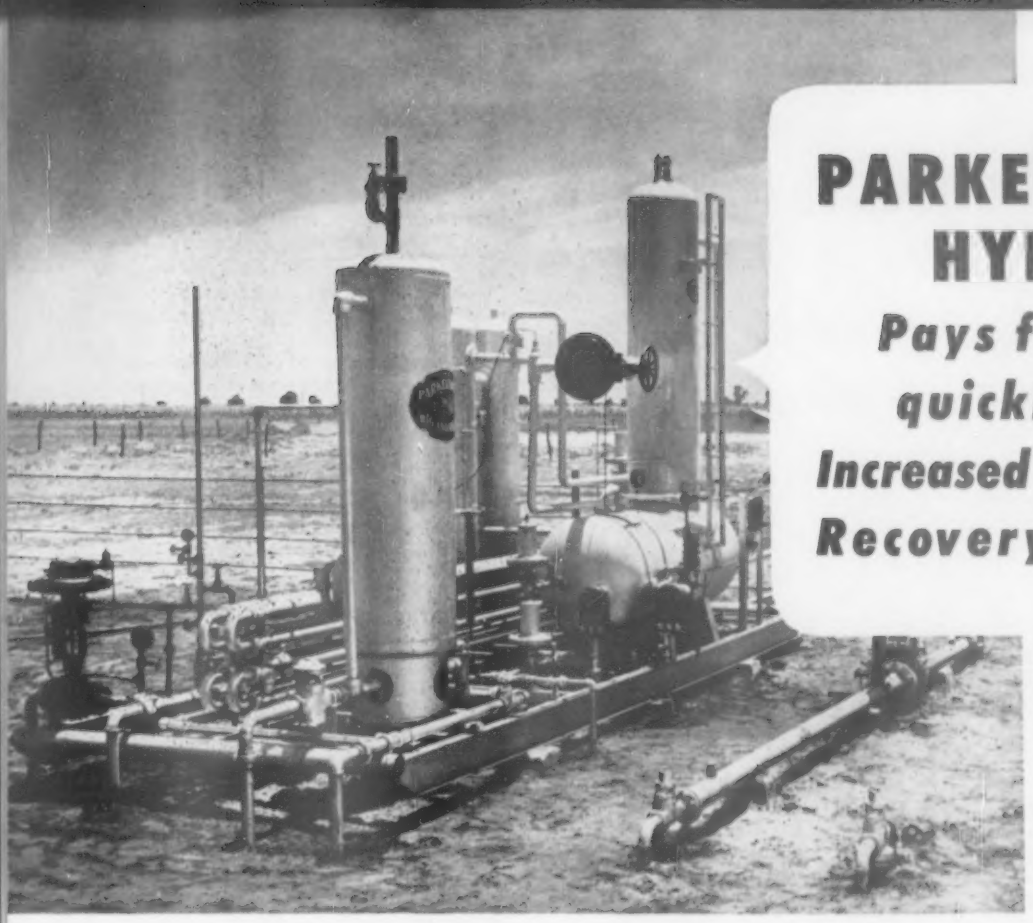
Michel T. Halbouty's deep wildcat 2 miles southeast of Blessing field, in western Matagorda County, is being completed as a gas well in a lower Frio sand perforated at 9,220-30 ft. Although tests of a middle Frio sand, perforated at 8,412-20 ft., yielded some oil, a completion in that zone will not be attempted at this time.

From the 9,200-ft. sand, the well flowed at the rate of 3,000,000 cu. ft. of gas per day through ¼-in. choke with pressure of 2,000 psi. Gas sprayed condensate, but volume was not gaged.

The well, 1 McDonald, in the W. Kierans Survey, was drilled to 10,791 ft. Location is 8 miles north of Palacios.

Oil Production Extended

Production at Mykawa, just southeast of Houston, in Harris County, is being extended to the north flank of the dome at a point more than a mile from nearest other production around the dome. Location is 2 miles west of Houston's International Airport.



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The Parkersburg Hyreco is available in capacities from 5 to 20 MMCF/D; pressures from 2000 to 6000 psi with either single tube or twin tube vertical knockout for liquid or water removal.

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WESTERN CANADA

ALBERTA

Brinkerhoff Gets Strike at Ardrossan

A drilling contracting firm in western Canada's oil development, Brinkerhoff Drilling Co., Ltd., who recently undertook to drill a number of test wells on acreage farmed out to it by Hudson's Bay Oil Gas Co., Ltd., in the central portion of Alberta was rewarded with oil discovery at the most recent driller on that tract. The strike was made at Brinkerhoff-Hudson's Bay 13-26 Ardrossan, on LSD 13, 26-52-22w4, which lies 1¾ miles south Ardrossan townsite, 11 miles east of Edmonton's city limits and 2¼ miles northeast of the Husky-Union-Imperial 1 Cooking Lake suspended wildcat which also indicated oil production from the D2 formation.

The D2 formation at this discovery was contacted around the 4,040-ft. level and two drill-stem tests, covering 10 ft. of that zone have been run. The first test in the horizon gave up gas at rate between 1,000,000 and 1,250,000 cu. ft. daily with oil reaching the surface in 16 minutes. There was a pipe recovery of 375 ft. of clean, 38°-gravity oil.

The next test, covering a 5-ft. interval and overlaping the first test by 2 ft. gave up a gas flow measured at 925,000 cu. ft. daily and also flowed oil to surface. The pipe recovery was 280 ft. of clean oil, no water. Coring and testing is being continued at the well in order to determine its commercial worth.

• An exploratory wellsite, which lies 28 miles southwest of Calgary's city limits and operated by Richfield Oil Corp. of California, flowed gas during Mississippian zone drill-stem test at estimated rate 5,000,000 cu. ft. daily and on the same test gave a pipe recovery of 400 ft. of 49°-gravity oil and 205 ft. of mud-cut salt water. The indicated discovery well, Richfield Medallion 6-16 Mazeppa, is being drilled by Richfield on acreage farmout out to it by Medallion Petroleums, Ltd., and is scheduled to test all prospective horizons down to and including the D1 zone of Devonian.

The strike lies on LSD 6, 16-19-27w4, miles southeast of gas production in the Okotoks area and is 15 miles east-northeast of the Texaco-C&E 1 High River, D1 zone oil discovery well. Mississippian contact at the well was made at 6,780 ft. and drill-stem test to indicated discovery was run 7 ft. below that contact point and covered a 31-ft. interval. Drilling has been resumed with latest depth reported as 7,620 ft. with D1 contact expected around 8,100 ft.

Use SpringKore flexibility and crush resistance to cut your rotary drilling line costs

J&L SpringKore Rotary Drilling Lines are designed with a tightly coiled, high quality steel spring center that replaces independent wire rope or hemp fiber core. The SpringKore center gives rotary drillers a wire rope with unusually high resistance to crushing action *plus* extreme flexibility.

Check these SpringKore features and see why J&L SpringKore gives you longer service life on your rotary rigs.

LONG-TERM FLEXIBILITY
SpringKore's highly flexible center and wide distribution of internal pressures maintains original rope flexibility under long periods of heavy-duty service.

RESISTS CRUSHING ACTION
Coiled steel spring center has great resistance to crushing . . . snaps rope back to its original shape and diameter.

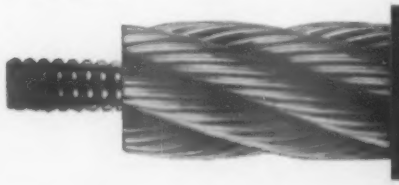
COMPLETE LUBRICATION
SpringKore's hollow center acts as a lubricant reservoir . . . reduces corrosion and friction wear by assuring lubrication of innermost parts of rope.

MORE SUPPORTING CONTACT POINTS
The coiled shape of the spring center gives the strands of the rope more supporting points . . . reduces friction by spreading pressure evenly over many contact points.

UNIFORM DIAMETER
The firm internal support provided by the spring center maintains uniform rope diameter . . . reduces wear caused by outer strands rubbing against each other.

LESS INSIDE STRAND WEAR
The spring center flexes under crushing instead of scoring strands . . . reduces wear on inside wires.

Put these SpringKore advantages to work on your rotary drilling rigs. Specify J&L SpringKore Rotary Drilling Lines. Available in standard sizes and construction.



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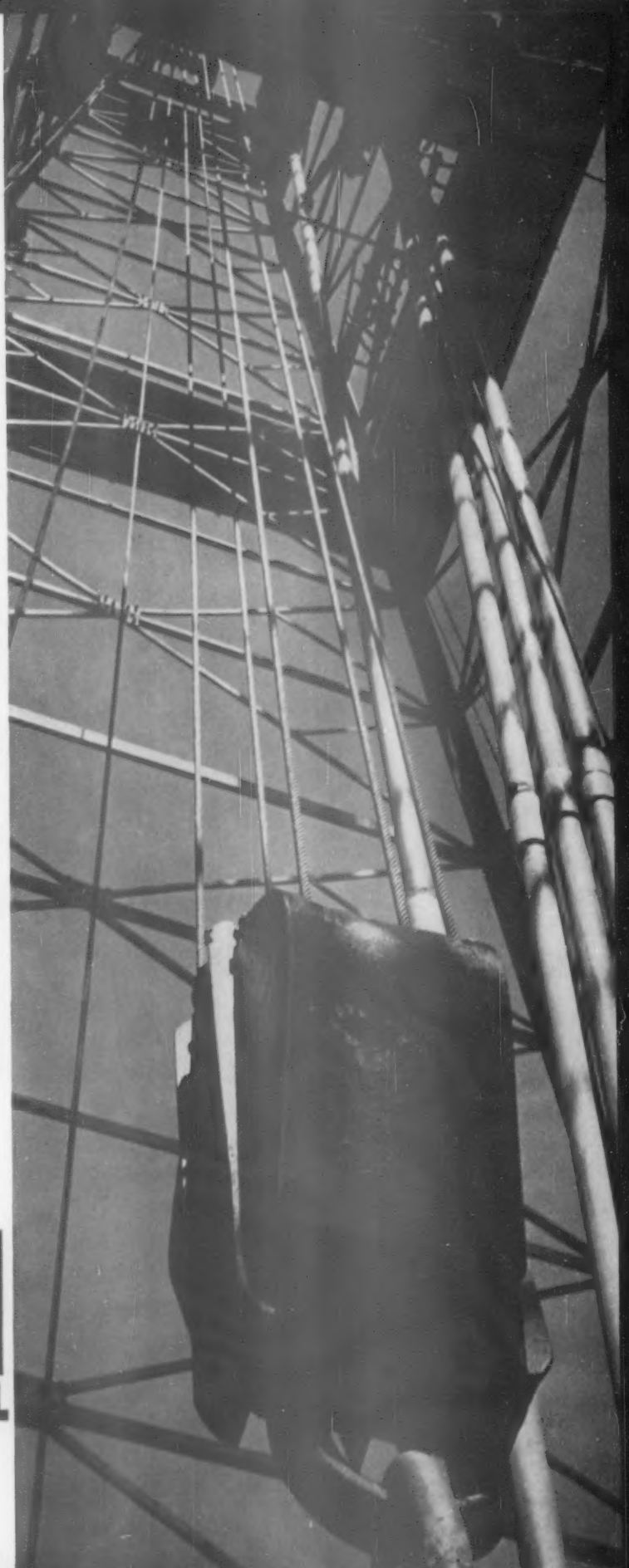

Speeds drilling under water with **DENISON** hydraulic equipment

SIXTEEN HOLES—90-feet deep—in only eight hours. That's the footage this barge-mounted shot-hole rig drills using Denison Pump/Motors and Denison Valves.

A Denison Pump/Motor powers the hydraulic system for this major oil company rig. Two additional Denison Pump/Motors rotate the drill and control pull-down of the rotary table. Accurate, fingertip control is provided by Denison hydraulic valves.

The hydraulically operated marine rig drills faster . . . is more dependable, easier to maintain than mechanically driven rigs.

Since the shot-hole crew paces the exploratory drilling team, it will pay you to take advantage of Denison's experience in hydraulics to speed drilling on land or under water. Write to:

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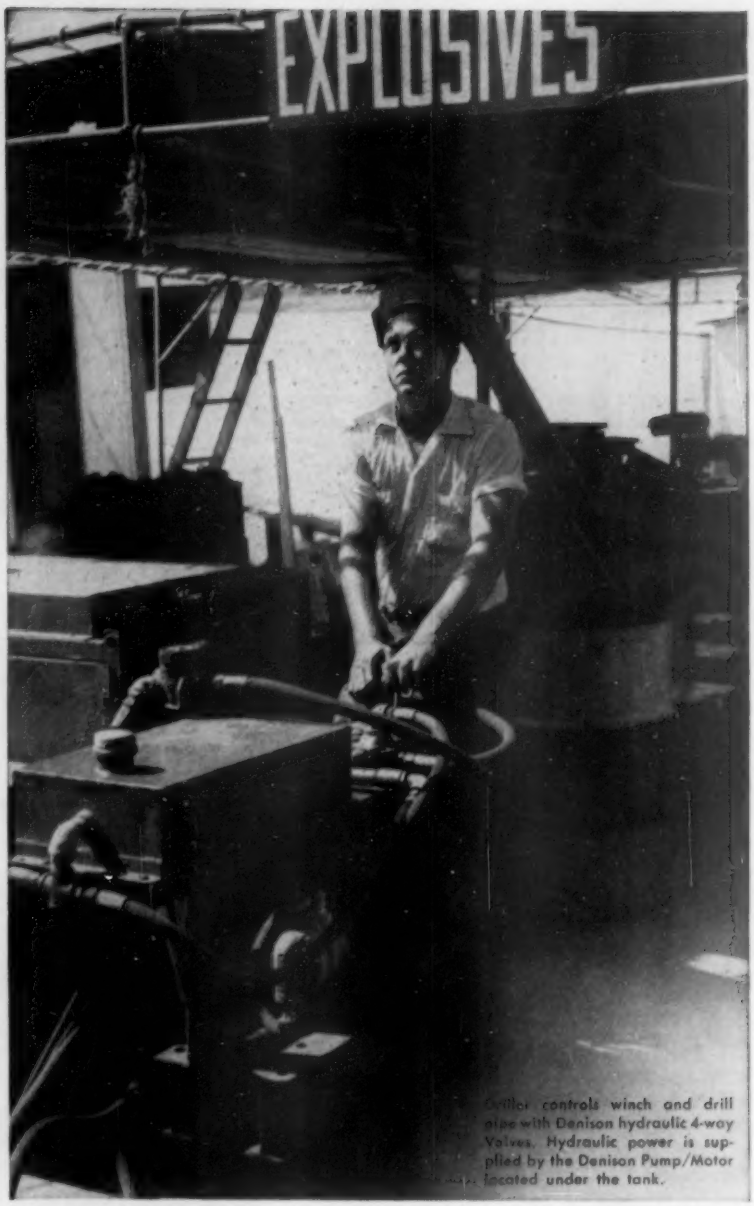
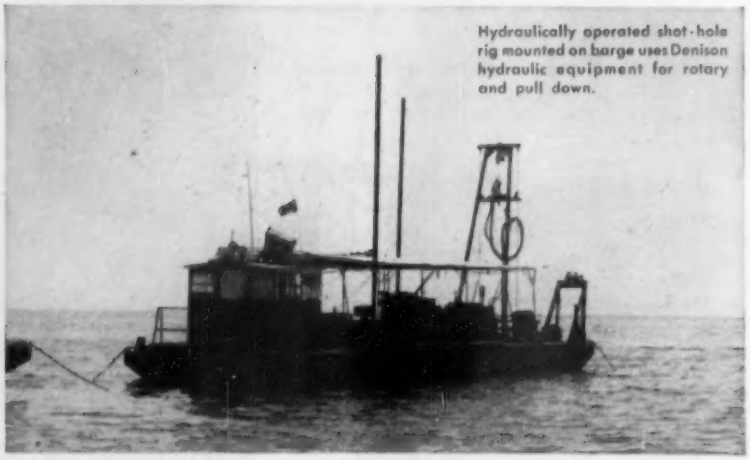


Driller controls winch and drill pipe with Denison hydraulic 4-way Valves. Hydraulic power is supplied by the Denison Pump/Motor located under the tank.



Hydraulically operated shot-hole rig mounted on barge uses Denison hydraulic equipment for rotary and pull down.

Third Gas Success Tapped at Savanna Creek

Phillips Petroleum Co. and Husky Oil & Refining, Ltd., tapped its third gas well on the Savanna Creek structure in southwestern Alberta. The new producer is 3A Savanna Creek, on LSD 5, 32-14-4w5, on top of the Plateau Mountain, 33 miles southwest of Nanton and 57 miles southwest of Calgary. The well flowed gas at the maximum rate of 3,900 M.c.f. per day on initial drill-stem test in the top of the Rundle. This flow is believed not a true well potential. The other two wells in this campaign have had large gas flows.

The 3A Savanna Creek well is located on a higher ground elevation than any other well in Canada. Kelly bushing elevation was 8,149 ft.

Another rig is working the area at A-1 Salter on LSD 4, 17-15-4w5, 3 miles north of the 3A well and 4½ miles north of the first two wells at Savanna Creek.

BRITISH COLUMBIA

Thirty Gas Wells Due Peace River

Up to 30 new gas wells in three fields of the Peace River area in British Columbia, Canada, will be drilled soon after January 1957, to develop some 130,000,000 cu. ft. a day of wet gas.

The gas is for delivery to the new Westcoast Transmission Co., Ltd., pipeline now under construction.

Sunray Mid-Continent Oil Co. has a substantial interest in the development. The new wells are being projected to augment the 158,000,000 cu. ft. a day of wet gas already available to meet the requirements of the pipeline by the fall of 1957.

Currently all of the drilling activity is centered in the Fort St. John and Southeast Fort St. John fields with four drilling rigs operating in each field. There are four producing zones in these two fields ranging from a depth of 3,200 ft. in the Cadomin to the Permo-Penn at 6,400 ft.

As of this date, 42 oil and gas wells have been completed in the two fields. These 42 wells have an open flow capacity of 558,000,000 cu. ft. a day or a deliverability of 140,000,000 cu. ft. a day of wet gas, which is based on 25 per cent of the open flow.

Plans call for these two fields furnishing 202,000,000 cu. ft. a day of dry gas required by next fall. The present deficiency of 62,000,000 cu. ft. of wet gas deliverability in these two fields will be met by the drilling of approximately 15 additional wells.

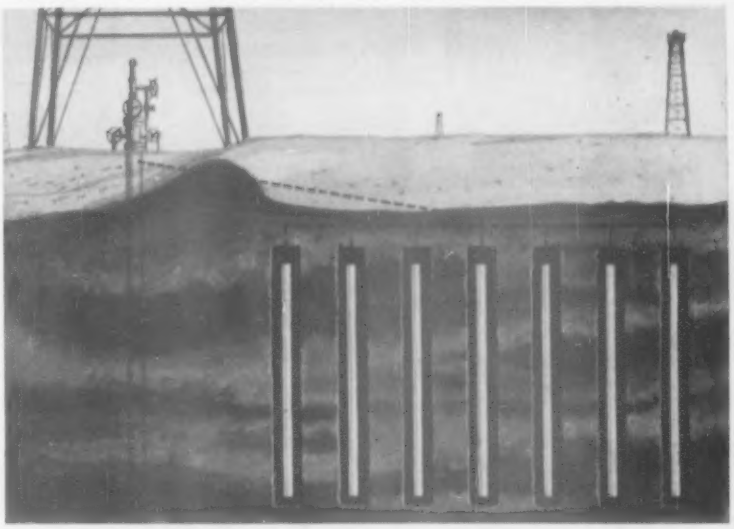
- There are two producing zones in West Buick Creek field. These are the Niganassin at a depth of 3,800 ft. and the Triassic "D" at a depth of 4,800 ft.

Five wells have been drilled to date in this field and four are capable of producing gas. These four wells have an open flow capacity of 72,000,000 cu. ft. a day and a deliverability of 18,000,000 cu. ft. a day of wet gas. Present plans call for this field to furnish 86,000,000 cu. ft. of the 288,000,000 cu. ft. required and the deficiency of 68,000,000 cu. ft. of wet gas will be supplied by the drilling of some 12 to 15 additional wells.

- The Westcoast Transmission line from the Peace River area to Vancouver, B. C., is now more than 50 per cent complete.

The field gathering system for the Fort St. John area will be installed during the next several months and the field gathering system from West Buick Creek field will be installed next spring.

The Peace River Natural Gas Co., Ltd., and Pacific Petroleums, Ltd., with whom Sunray is associated in the project, will deliver a total of 288,000,000 cu. ft. of dry gas a day to meet the first requirements of the pipeline which will carry gas fuel from Alberta and British Columbia to Canadian and American consumer markets in the Pacific Northwest.



OIL WELL CASING PROTECTED FROM EXTERNAL CORROSION

Magnesium anodes are now being used effectively to stop external corrosion on oil and gas well casing. Here's how one major oil company used this low-cost method on 130 wells, 5000 feet deep.

CSI engineers, who helped develop the method, provided a complete turn-key job. They first surveyed the wells, using special surface instruments, to determine the current density required for cathodic protection. Then they installed DOW magnesium anodes using CSI equipment and trained personnel. The installation was designed for a 10 year life.

CSI offers expert consultation and installation services, as well as a complete line of brand-name cathodic protection materials—for both anode and rectifier jobs.

Call or write for competitive cost estimates or quotations. Ask about the new Dow "Galvomag" which gives 20 to 35 per cent more current output than other anodes of similar size.

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October Scores in Pliocene and Cardium

by John C. McCaslin
District Editor

MOST of October's exploratory success ballots went to the West Coast and Alberta. The month, nationally, was one of the year's quietest on the wildcat front. Until the past few weeks exploration in California was at low tide—then along came the Pliocene push at Oakridge, a renewal of the San Mateo County play up near the Bay area, and what is being hailed as the most significant hit in the southern San Joaquin Valley in several years.

Up on the topside of the North American wildcat map a shower of red discovery pins was dotting Alberta. The Cardium is yielding its second best oil field since Pembina at Keystone. Union of California is moving in to follow up the Red Earth discovery of last winter—a program that bears close scrutiny. The big Mississippian reservoir at Westward-Ho moved 2 miles north to the tune of 732 bbl. per day.

California comes back strong . . . Ventura County's Oakridge thrust fault has turned up one of the most prolific discovery areas in California in some time.

The first inkling of this Pliocene prize came in 1952 at Harry C. Long's Basolo pool discovery at Shiells Canyon. This success hinted of a long string of anticlines associated with the fault, all possible Pliocene oil fields. Then came Saticoy, two Bridge area strikes, and Bardsdale. Oakridge fault includes six anticlines, five of them producing.

Pliocene oil along the trend is being found below Oligocene, Miocene, and Eocene production. This unique condition results from drilling through or below the Oakridge fault where the dips on the outer rim of the north flank are steeply overturned. The Pliocene reservoirs are formed where sands are closed up against the underside of the fault.

Shell Oil Co. and Union Oil Co. of California tapped two clues to the future of the entire length of the Oakridge uplift string of anticlines. Shell 1 Shell Universal-Consolidated Harvey, 1 mile east of the Bridge area, flowed 460 bbl. of oil per day from two zones in the Santa Barbara-Pliocene. Union's 1 Irwin-Berylwood flowed 650 bbl. per day. This well is 8 miles east of the Bridge area, extending the chain of fields along the Oakridge fault to 12 miles.

The discovery of Bridge field and its subsequent development in recent months is tagged as California's most

Total October Completions, Exploration and Development

	Total completions					Total wildcat wells					Cable tool comp.	Active operations
	Total	Oil	Gas	Dry	Footage	Total	Oil	Gas	Dry	Footage		
Alabama	10	8	0	2	90,820	2	0	0	2	7,234	3	18
Arkansas	112	82	3	27	318,705	17	1	3	13	65,283	7	119
California	186	143	7	36	789,627	33	4	0	29	177,956	3	215
Colorado	119	30	9	80	590,932	67	3	3	61	319,876	0	91
Florida	3	0	0	3	20,701	3	0	0	3	20,701	0	2
Georgia	1	0	0	1	3,980	1	0	0	1	3,980	0	1
Illinois	385	149	16	220	863,845	80	5	0	75	180,156	110	464
Indiana	75	25	0	50	126,857	15	1	0	14	24,683	28	87
Kansas	423	190	41	192	1,510,604	103	16	5	82	415,813	49	405
Kentucky	211	78	22	111	305,847	51	5	0	46	74,523	150	227
West	190	78	1	111	256,387	51	5	0	46	74,523	129	179
East	21	0	21	0	49,460	0	0	0	0	0	21	48
Louisiana	336	153	44	139	2,388,484	78	17	7	54	699,740	0	448
North	170	85	19	66	624,029	30	5	0	25	152,593	0	182
South	143	59	21	63	1,504,721	42	9	6	27	473,806	0	206
Offshore	23	9	4	10	259,734	6	3	1	2	73,341	0	60
Michigan	45	26	2	17	122,161	14	2	1	11	33,174	35	111
Mississippi	39	15	0	24	303,875	18	2	0	16	144,446	0	36
Montana	48	23	0	25	249,473	21	1	0	20	94,254	7	76
Nebraska	74	19	1	54	391,826	41	2	1	38	202,764	0	31
West	71	19	1	51	384,754	38	2	1	35	195,692	0	25
East	3	0	0	3	7,072	3	0	0	3	7,072	0	6
New Mexico	142	48	68	26	628,484	29	9	1	19	161,071	21	201
Northwest	83	6	65	12	321,979	12	3	0	9	44,659	0	79
Southeast	59	42	3	14	306,505	17	6	1	10	116,412	21	122
New York	56	23	3	30	89,157	4	0	1	3	15,311	56	49
North Dakota	31	21	0	10	229,634	7	0	0	7	41,716	0	33
Ohio	111	57	22	32	252,206	2	0	2	0	7,543	109	165
Oklahoma	661	387	35	239	2,234,749	69	14	4	51	342,845	114	810
Pennsylvania	34	0	28	6	110,256	6	0	3	3	48,514	29	77
South Dakota	1	0	0	1	586	1	0	0	1	586	0	2
Texas	1,783	1,078	83	622	7,714,120	469	71	24	374	2,316,934	76	1,340
Southwest (1)	121	66	2	53	274,462	49	3	2	44	110,483	2	73
Gulf Coast (2)	58	15	12	31	372,032	31	4	2	25	211,618	0	47
Gulf Coast (3)	144	72	11	61	1,008,576	42	5	4	33	363,428	0	157
Southwest (4)	130	55	21	54	647,470	52	6	10	36	284,631	0	79
East (5 & 6)	106	42	10	54	591,727	44	2	1	41	238,185	2	106
West Central (7-B)	239	125	0	114	843,948	72	7	0	65	270,881	14	154
West (7-C & 8)	483	394	10	79	2,490,481	76	22	2	52	470,875	27	502
North (9)	380	215	5	160	963,567	89	18	1	70	276,000	31	111
Panhandle (10)	122	94	12	16	521,857	14	4	2	8	90,833	0	111
Utah	8	5	0	3	38,869	6	3	0	3	27,212	0	32
West Virginia	76	7	53	16	209,500	3	0	2	1	9,858	73	205
Wyoming	109	44	9	56	422,780	42	1	2	39	170,636	17	119
Total October 1956	5,079	†2,611	446	*2,022	20,008,078	1,182	157	59	966	5,606,809	887	5,364
Total September 1956	4,370	2,245	340	1,785	17,506,624	1,042	128	42	872	4,973,820	790	5,440
Cumulative 1956	48,949	26,406	3,469	19,074	197,095,624	10,901	‡1,399	379	9,123	52,073,096	8,105	
Cumulative 1955	47,229	26,457	2,947	17,825	188,661,318	10,223	1,536	298	8,389	49,081,040		
Western Canada	326	224	22	80	1,476,228	70	10	6	54	338,355		
Alberta	154	109	15	30	805,986	29	4	6	19	156,949		
Saskatchewan	142	95	4	43	589,571	37	6	0	31	168,764		
Manitoba	27	20	0	7	64,710	4	0	0	4	12,642		
British Columbia	3	0	3	0	15,961	0	0	0	0	0		
Alberta 1956	1,564	1,169	110	285	8,418,938	296	50	42	204	1,726,070		
Saskatchewan 1956	878	627	9	242	3,659,034	240	58	0	182	1,045,827		
Manitoba 1956	196	152	0	44	458,292	35	3	0	32	108,150		
British Columbia 1956	43	3	28	12	255,767	22	0	10	12	148,822		
Canada 1956	2,681	1,951	147	583	12,792,031	593	111	52	430	3,028,869		

*Incl. 80 service wells: Kans. 4, Ky. 1, N. Y. 23, Ohio 6, Okla. 41, West Cent. Tex. 1, N. Tex. 4. †Incl. 38 dist. wells: Kans. 2, S. La. 11, La. offshore 1, Okla. 14, Tex. Dist. (2) 4, Dist. (3) 2, E. Tex. 1, Tex. Panh. 2, Miss. 1. ‡Incl. 11 dist. disc.: Kans. 2, S. La. 3, La. offshore 1, Okla. 2, Tex. Dist. (2) 2, Panhandle 1.

important exploratory event in recent drilling history. There are seven wells, all flowing about 600 bbl. per day.

. . . In the San Joaquin. Union Oil Co. put the Arvin area in the southern San Joaquin Valley on the success map in a big way. The 55-X-21 Stenderup flowed 1,213 bbl. of oil per day from the Derby sands at 9,525-9,717 ft. The discovery, which is being lauded as one of the best valley strikes in some time, is 1 mile west of the Arvin area production in Mountain View field.

. . . In San Mateo. Activity in San Mateo County in northern California is on the upgrade again after a series of dry holes hit operators in the Oil Creek area—a 1955 discovery highlight. Half a dozen tests are under way or slated near Oil Creek.

Alberta retakes initiative . . . The exploratory scene in western Canada shifted back to Alberta in October with Keystone, Crossfield, Red Earth, and Westward-Ho on stage.

. . . No. 2 Cardium area. The recent Keystone - Cardium discovery midway between Pembina and Bonnie Glen fields forces a new concept of this greatest of all Canadian pay sands.

Keystone was discovered in July by Cities Service Oil Co. The followup well flowed 592 bbl. per day, natural, pegging it as one of the best Cardium wells yet. No fracture treatment is necessary at Keystone. The field now has four producers with two nearing completion. Cities Service has announced location for a key test 6 miles away.

Shell Oil Co. opened Cardium production just 18 miles north of Calgary

Completions By Depth Classifications, October 1956

	A 0-1,250 ft.	B 1,250-2,500 ft.	C 2,500-3,750 ft.	D 3,750-5,000 ft.	E 5,000-7,500 ft.	F 7,500-10,000 ft.	G 10,000-12,500 ft.	H 12,500-15,000 ft.	I Over 15,000 ft.
Alabama	0	1	1	0	1	2	5	0	0
Arkansas	5	66	24	8	8	1	0	0	0
California	20	44	28	34	32	22	5	1	0
Colorado	0	3	15	50	47	4	0	0	0
Florida	0	0	0	0	2	1	0	0	0
Georgia	0	0	0	1	0	0	0	0	0
Illinois	49	166	166	4	0	0	0	0	0
Indiana	35	24	16	0	0	0	0	0	0
Kansas	3	45	222	125	28	0	0	0	0
Kentucky	110	80	21	0	0	0	0	0	0
West	101	76	13	0	0	0	0	0	0
East	9	4	8	0	0	0	0	0	0
Louisiana	8	62	46	26	40	48	62	34	10
North	8	62	44	18	24	11	2	1	0
South	0	0	2	8	13	32	52	29	7
Offshore	0	0	0	0	3	5	8	4	3
Michigan	0	22	15	5	3	0	0	0	0
Mississippi	0	0	0	3	18	10	7	1	0
Montana	2	8	7	6	13	12	0	0	0
Nebraska	1	2	8	13	50	0	0	0	0
West	1	0	7	13	50	0	0	0	0
East	0	2	1	0	0	0	0	0	0
New Mexico	2	36	30	31	29	2	6	6	0
Northwest	0	26	16	14	27	0	0	0	0
Southeast	2	10	14	17	2	2	6	6	0
New York	0	50	1	5	0	0	0	0	0
North Dakota	0	0	4	2	5	20	0	0	0
Ohio	29	18	62	2	0	0	0	0	0
Oklahoma	95	182	176	96	80	27	2	1	2
Pennsylvania	0	1	18	1	11	3	0	0	0
South Dakota	1	0	0	0	0	0	0	0	0
Texas	157	399	330	293	343	187	45	25	4
Southwest (1)	51	27	24	8	9	0	1	1	0
Gulf Coast (2)	3	0	3	17	7	25	3	0	0
Gulf Coast (3)	6	7	9	12	34	56	15	1	4
Southwest (4)	3	24	20	13	43	23	4	0	0
East (5 & 6)	1	13	9	11	56	14	2	0	0
W. Central (7-B)	26	71	46	41	54	1	0	0	0
West (7-C & 8)	7	49	113	141	84	46	20	23	0
North (9)	60	201	29	47	41	2	0	0	0
Panhandle (10)	0	7	77	3	15	20	0	0	0
Utah	1	0	1	0	6	0	0	0	0
West Virginia	6	35	18	14	1	2	0	0	0
Wyoming	10	30	24	20	18	6	0	1	0
Total Oct. 1956	534	1,274	1,233	739	735	347	132	69	16
Total Sept. 1956	454	1,011	1,061	715	615	304	125	71	14
Cum. 1956	4,730	11,804	11,951	7,560	7,183	3,538	1,408	664	111
Western Canada	1	51	40	132	78	21	3	0	0
Alberta	0	17	17	25	73	19	3	0	0
Saskatchewan	0	16	16	104	4	2	0	0	0
Manitoba	1	18	7	1	0	0	0	0	0
British Columbia	0	0	0	2	1	0	0	0	0
Cum. 1956	16	296	338	918	910	173	22	8	0

at Crossfield. Cardium oil also was found on tests at Warburg, 6 miles east of Keystone field. All these Cardium events in areas where the Cardium wasn't supposed to be are tools for the stratigrapher in uncovering the sand's baffling extent in western Canada.

. . . **Back to Red Earth.** After a summer's absence due to seasonal mire, Union Oil Co. of California is back to the Red Earth Granite Wash discovery area 80 miles east of Peace River with 12 wells on the lineup for winter drilling. The Red Earth discovery, which was the most significant discovery of the year in Alberta, and which is the best Granite Wash oil strike to date in Canada, fired the biggest land play in Canadian history last winter.

. . . **Eagle Hills.** Hudson's Bay Oil & Gas Co., Ltd., 1 Eagle Hills, a 2-mile north extension to oil-rich Westward-Ho field, flowed 732 bbl. of oil per day from 40 ft. of Mississippian pay on 30/64-in. choke during a 13½-hour period.

Regional Events

The remaining October wildcat events were in Wyoming, Oklahoma, West Texas, Utah, Arkansas, and Nevada.

New pay . . . The first well to test the Tensleep in East Salt Creek field, Natrona County, Wyoming, was completed as a new-pay discovery in that formation. Sinclair Oil & Gas Co. 8 Government had a calculated potential of 1,944 bbl. of oil per day.

Oklahoma . . . Impressive Ordovician and Siluro-Devonian discoveries in the Criner district of McClain County in the south-central part of the state pave the way for a definite pickup in wildcat and development work in this area. Two good oil strikes in the Tulip Creek, Bromide, and Hunton in the area are enjoying rapid development plays and long stepout tries.

Blaine County in northwestern Oklahoma is a new producing county for the state. John Coyle, Jr. et al. 1 Dougherty, 13 miles south of Ringwood field, flowed 3,735 M.c.f. of gas per day from the Chester-Mississippian. Location of the rank strike is just off the northeast rim of the Anadarko basin.

Arkansas . . . Carter Oil Co. completed the largest gas well ever drilled in northern Arkansas. The 1 L. B. Caroister flowed open 78,540 M.c.f. of gas per day. Location is in Moreland field, 10 miles north of Russellville.

Nevada . . . Richfield Oil Corp. is drilling a 6,500-ft. Humboldt wildcat in Elko County, 56 miles northwest of Elko in an area of no previous drilling. Nearest previous test is 45 miles southeast.

Utah . . . The first discovery in the Uinta basin of northeastern Utah in some time flowed oil at the rate of 45 bbl. per hour from the Green River-Tertiary. Havenstrite Oil Co. 72-22 Federal Uintah County, opened production in the Ute Trail area, 17 miles west of Chapita Wells.

West Texas . . . Exploratory and development interest in the Permian basin is centered in Irion County, a comparative newcomer to West Texas' producing column.

More than a dozen new discoveries have dotted this county near the southern end of the Eastern Shelf. Production to date has been tapped in the Ellenburger, Strawn, Canyon, Wichita (Wolfcamp), Spraberry, Leonard (Clearfork), and San Angelo formations. Keep a close watch on Irion County in the coming exploratory months. It may well be the No. 1 hunting ground for oil in West Texas.

WEST TEXAS-NEW MEXICO

WEST TEXAS

Second McKee Producer In East Abell Field

The East Abell multipay field of northern Pecos County gained its second McKee sand well shortly after the discovery had been potentialed.

The new well is Montex Drilling Co.

BIW Non-Lubricated Gate Valves NEVER NEED GREASE JOBS

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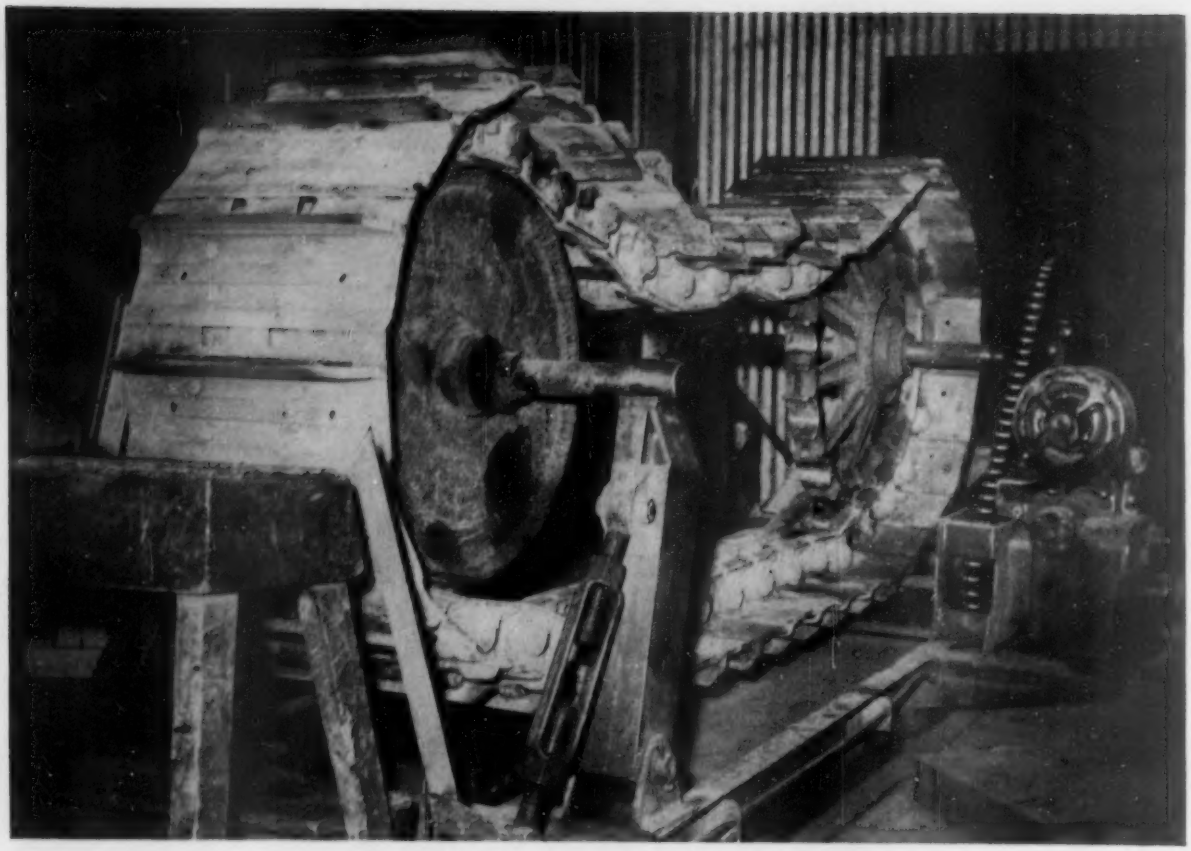

Positioning Fixture for REBUILDING and HARD-FACING TRACTOR GROUSERS

With spreads operating throughout the Western States from New Mexico to Washington, the Isbell Construction Co. with its head office in Reno has complete facilities for maintenance of heavy earth working equipment at its home base. A fixture for positioning crawler track assemblies to speed the repair of grousers is so ingenious as to have attracted wide attention.

In order to keep their tractors moving, the shop has in stock spare tracks for replacement; when grousers are worn, the track is taken off the crawler and sent to the shops, the replacement assembly is supplied and the tractor goes back to work. The old track is mounted on the fixture shown above and, as time permits, the shop weldors handle the rebuilding job. The fixture has a conventional idler and sprocket on which the track is mounted, the device being adjustable to handle a track assembly of varying length. The sprocket is power driven through a gear reducer.

The assembly is rotated so that a weldor can work on grousers at either end, welding in down hand position. The worn grouser is squared up by a cutting torch and steel bar stock, ½"x1¼", is welded on with high tensile electrodes. After the bar is welded in position a single heavy stringer bead of Stoody Self-Hardening is run across the top to give it extra wear protection.

The company has found that this fixture cuts welding time in half, simplifies handling of the track assembly and the use of hard-facing alloys stretches out service life between track overhauls.

The Stoody Guidebook—the "Bible" of heavy equipment maintenance—is yours for the asking. For your nearest Stoody dealer check the "Yellow Pages" of your phone book or write direct.

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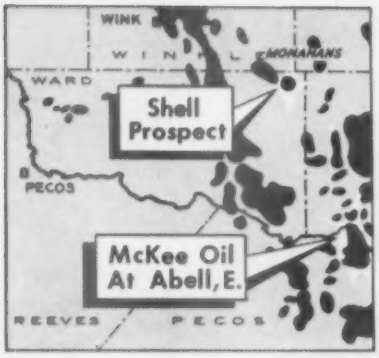

Shell Oil 1-A Sealy-Smith, 2 miles east of Monahans field, reported oil shows on tests of the Ellenburger. New area east of Imperial gets second well in McKee section.

1 W. K. Heagy, in 9-3-H&TC, southeast of Imperial. Final gage on the McKee was 298 bbl. of 42° oil a day through 20/64-in. choke, from perforations at 5,415-38 ft. Gas-oil ratio was 761:1 and tubing pressure was 375 psi.

From the Waddell it flowed at the rate of 434 bbl. of 41° oil a day, through 18/64-in. choke, from perforations at 5,897-5,909 ft. Flowing pressure was 475 psi.

The McKee discovery for the area was Great Western Drilling Co. 1 Cotten, in 10-3-H&TC. It also was a dual completion, making 247 bbl. of oil a day from McKee perforations at 5,434-40 ft., and 434 bbl. of oil a day from the Waddell at 5,880-90 and 5,896-5,914 ft.

McLish prospect . . . Republic Natural Gas Co. 1 Arthur Duval, 3½ miles southeast of Imperial in Section 1, Block 3, H&TC Survey, reported a flow of oil while drill-stem testing in the McLish at 5,303-5,548 ft.

On the test, gas surfaced in 4 minutes, mud in 7 and oil in 13, at the rate of 15 bbl. an hour. The well unloaded 15 bbl. of oil after the tool was closed. Recovery in the pipe was oil, with no water. Flowing pressure ranged from 1,420-1,670 psi., and 1-hour shut-in pressure read 2,530 psi. Operators prepared to drill ahead, to projected depth of 6,400 ft.

The McLish is a formation of Middle Simpson age, of which the Waddell is a member, according to The Oil and Gas Journal's County Correlator for Texas Oil.

Ector County . . . The Jordan, South (Fusselman) field, located about 5 miles south of the town of Penwell, gained a second producer and ½-mile east extension. The Texas Co. 27 Ida McDonald, 27-B16-PSL, completed for 477 bbl. of 41° oil a day from pay perforations at 7,494-7,519 ft. This well entered the pay at 7,494 ft. on ground elevation of 2,837 ft. Texaco opened the field with its 26 McDonald, for 261 bbl. a day from pay at 7,505-25 ft.

SOUTHEAST NEW MEXICO

New Lea County Area Gets Extension and Discovery

Sinclair Oil & Gas Co.'s new Pennsylvanian field in western Lea County had a second well ready for completion last week, and slightly over a mile farther southeast, another Pennsylvanian, or Permo - Pennsylvanian structure had been tapped.

Sinclair's second well is the 2 Seaman Unit, located in the northwest corner of 19-16s-33e, making it a two-location southeast extension to the discovery. Operators ran casing to 11,500 ft. after the well flowed 38.64 bbl. of oil in 1 hour on a test between 11,335-67 ft. The well also recovered oil on a test of the Wolfcamp at 10,130-10,204 ft.

The new discovery is Tennessee Gas Transmission Co. 1-A State-Kemnitz, in NE NE NE 30-16s-34e, 13 miles west of Lovington and southeast of Seaman field.

On a 2-hour and 49-minute test at 10,640-10,731 ft. gas flowed in 16 minutes, increasing in volume to 3,000

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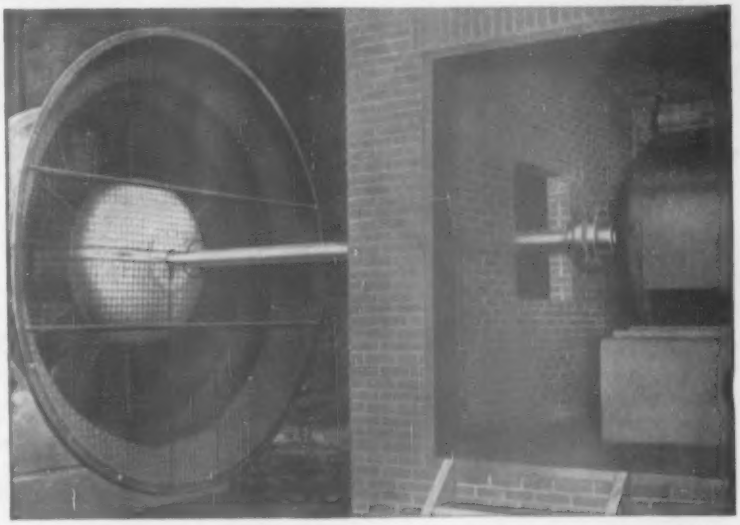

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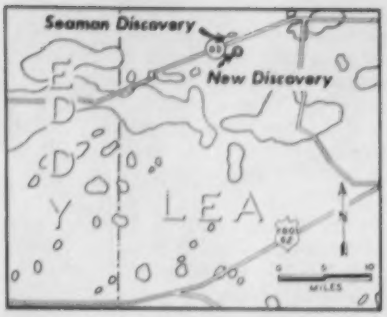

Sinclair Oil & Gas has added a second Pennsylvanian well to its Seaman Unit discovery, and farther southeast, Tennessee Gas Transmission 1-A State-Kemnitz had a Pennsylvanian discovery in the making.

M.c.f. per day. Oil reached the surface in 35 minutes, and flowed 13 bbl. in 16 minutes through 1-in. choke. When changed to ⅝-in. choke, it flowed 167 bbl. of 41° oil, with no water, in 2 hours. Operators drilled to 10,763 ft. for further testing. Projected depth was 11,500 ft.

A third producer and second Devonian well has been established at South Four Lakes field in northwestern Lea County. Humble Oil & Refining Co. 3 South Four Lakes, in NW NW NW 1-12s-34e, flowed 36 bbl. of oil through ⅜-in. choke in 4 hours, from perforations in the Devonian at 12,817-67 ft. The flow died at that time and operators started swabbing.

SOUTH LOUISIANA

LOUISIANA GULF COAST

St. Landry Discovery Is Second in Two Weeks

St. Landry Parish's second new-field discovery within two weeks was recorded last week with the completion by California Co. of a gas-condensate producer in its 1 Gabe Young, a wildcat 2 miles north of Savoy field, in the parish's "panhandle" strip.

It is less than 10 miles west and a little north of Olin Oil & Gas Corp.'s gas-condensate discovery-well completed the previous week. The latter discovery *(The Oil and Gas Journal, November 19, 1956, issue, page 387)* was in Olin's 1 Higginbotham, 2 miles north of Lewisburg field.

California Co.'s well is productive from a 6-ft. perforated interval at 8,350-56 ft. after backing up from a drilled depth of 10,500 ft. Flow through 5/32-in. choke was gaged at 1,676,000 cu. ft.

ST. LANDRY'S PARISH'S "panhandle" area showing locations of California Co.'s gas-condensate discovery well (A), and Olin Oil & Gas Corp.'s previous-week discovery (B), 10 miles southeast.

of gas and 36 bbl. of 62.3°-gravity condensate per day. Its pressure held at 2,800 psi.

Logging had indicated another gas sand below 10,140 ft., but tests of an interval at 10,140-44 ft. got salt water with only a slight show of gas while swabbing. Olin's well, in which Drilling & Exploration Co., Inc., held an operating interest, produces from pay at 9,380-84 ft.

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Model A-4-6-S for 6 volt batteries
Model A-2-12-S for 12 volt batteries
Model A-4-12-S for 12 volt batteries
Model B-2-6-S for 6 volt batteries
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LOCATION of Glasscock-Tidelands gas discovery (indicated on map) in eastern arm of Iberia Parish.

Deep Sand Produces Gas In Iberia Parish Wildcat

C. G. Glasscock and Tidelands Oil Co. have a dry-gas well in their Cocke & Goodrich wildcat in the eastern arm of Iberia Parish, scene of two other new-field discoveries this year.

It is 3½ miles east of Bayou Pigeon field. Big Bayou Pigeon and Bayou Postillion fields, opened early this year, are located 4 miles southwest and 3½ miles southeast, respectively. It is 5 miles north of the larger Bayou Long field, in northern St. Martin Parish.

Productive interval in the Glasscock-Tidelands discovery is at 12,112-19 ft. Flow was 900,000 cu. ft. per day through ⅞-in. choke with pressure running from 590 to 900 psi. Shut-in pressure is 5,700 psi.

Extension Well Finaled In Abandoned Bel Area

Serio - Punches Oil Co.'s extension discovery well southeast of the old Bel area, in southwestern Allen Parish, produced at the rate of 132.48 bbl. of 49°-gravity oil per day through 5/32-in. choke during its potential gage. The flow was with gas-oil ratio of 1,622 cu. ft. per bbl. and pressure of 950 psi.

The well, 1 Bel Lumber, in 29-6s-7w, is productive from a lower Frio sand at 10,065-70 ft. after having been drilled to 10,405 ft.

First production in the area was opened in 1952. The discovery well, the only producer until now, was abandoned the following year. Its production was from a 5,200-ft. middle Oligocene sand.

First Production Assured In Willis Point District

The Willis Point area, on the east side of the Mississippi River, in Plaquemines Parish, 15 miles southeast of New Orleans, is proving productive in a discovery by California Co. at its 2 Morris Steinberg. Nearest other production is at Stella, 5 miles northwest.

Production is gas with 45.2°-gravity condensate from a casing-perforated interval at 10,178-96 ft. The well is reported to have logged more than 50 ft. of net sand. Hole was drilled to 10,502 ft. and has casing at 10,500 ft.

Testing still is under way. Through 9/64-in. choke the well flowed at the rate of 5,207,000 cu. ft. of gas and 48 bbl. of condensate per day. Flowing pressure was 3,800 psi. Pressure, when the well was shut-in after the test, built up to 4,000 psi.

Outpost Producer Revives Old Bayou Chopique Area

The Bayou Chopique area, 15 miles southwest of Lake Charles, in southern Calcasieu Parish, is being revived by a gas-condensate discovery in a wildcat drilled by Samedan Oil Corp. northeast of the original production.

The area was opened for production in 1946 by Union Sulphur Co. (now Union Oil & Gas Co.) with an 8,825-ft. oil producer. Two additional productive wells, extending the field north and east and proving at least one additional pay zone, have been completed, the last early in 1953. No production has been reported since that year.

The Samedan well is its 1 West, in 16-11s-10w. It was drilled to 13,545 ft., and has casing at 10,371 ft. Tests of sand perforated at 8,731-36 ft. got a flow estimated at 1,032,435 cu. ft. per day, with condensate recovery of 25 bbl. per 1,000,000 cu. ft. Pressure was 1,150 psi., flowing, and 2,950 psi., shut-in.

Former production in the area was from Anahuac-Marginulina sands at 8,600 ft. and 8,825 ft.

LOUISIANA OFFSHORE

West Delta Area Wildcat Opens New Offshore Field

Humble Oil & Refining Co. is opening another offshore field. Discovery well, in Block 25, West Delta area, Gulf of Mexico, is just off the west side of Plaquemines Parish's Mississippi River delta.

Testing casing-perforated interval at 8,295-8,305 ft., in hole drilled to 10,424 ft. and plugged back to 10,087 ft., the well flowed 154.7 bbl. of 25°-gravity oil per day through ⅛-in. choke. Gas-oil ratio was 383 cu. ft. per barrel and pressure of 820 psi.

Location lies between West Delta Block 25 field, on the west, and the large West Bay field, to the east in the delta marsh area.

Shallower Pay Produces In First Offshore Field

Creole (West Cameron Block 2), Louisiana's first field in open waters of the Gulf of Mexico, is getting its first new well in recent years. It is being completed in a sand not previously produced in the area. The sand, perforated at 3,095-98 ft., is the shallowest to date.

The well was drilled by Pure Oil Co.

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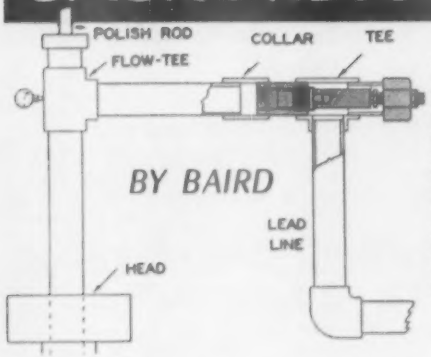

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For wells that head up and flow, back pressure on the tubing tends to keep the tubing full which prevents stuffing box trouble and increases pump efficiency. By maintaining a back pressure on the tubing, this regulator keeps gas from breaking out of the solution and thus helps to prevent paraffin formation.

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on its State Lease 2760. Hole was taken to 12,257 ft., but has been plugged back to 4,683 ft. for completion. From the above sand, the well flowed clean oil. No gage was reported. Pressure through 7/64-in. choke was 800 psi. Another shallow sand will be tested before final completion of the well.

The field, located about 1½ miles off Cameron Parish, was opened in 1938 by Superior Oil Co., with Pure Oil Co. as 50 per cent owner. Eight productive wells have been drilled, although only four now are listed as producing. Production has been from Miocene sands at 5,100 ft., 6,700 ft., and 6,800-6,900 ft.

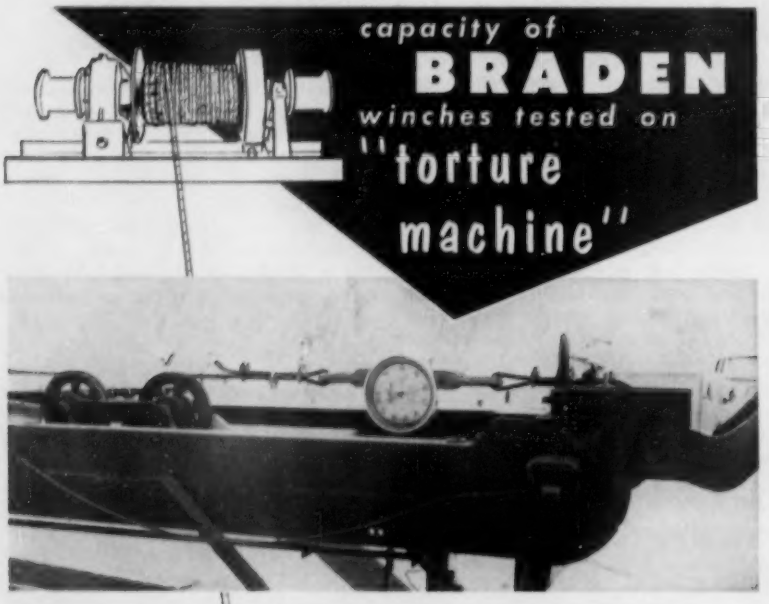
ARK-LA-TEX

NORTH LOUISIANA

Wilcox Pay Reported At Catahoula Wildcat

A wildcat prospect in Catahoula Parish, east-central Louisiana, netted 10 ft. of Wilcox sand pay. The discovery well is H. L. Rowley, Inc. 1 Renfrow, NE NW 24-8n-6e, 2½ miles west of West Pool Lake field, 2 miles north of Jonesville.

Electric log indicated the Wilcox pay at 4,471-83 ft.



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BRADEN Winches

Ouachita Wildcat Is Cotton Valley Prospect

Stanolind Oil & Gas Co. 1 Tina S. Parker in C NW SE 5-17n-3e, a possible Cotton Valley gas discovery in central Ouachita Parish, 1½ miles west of Brownsville, is taking drill-stem test at 9,703-9,898 ft.

SOUTHEASTERN STATES

MISSISSIPPI

Wilcox Sand Produces in Another Adams Discovery

Norman Germany and G. W. Gulmon are completing their 1-B Butler, southwestern Adams County wildcat as a Wilcox discovery-well with pay perforated at 6,452-54 ft. It flowed 124 bbl. of 44°-gravity oil per day through ⅛-in. choke, registering pressure of 285 psi. Shut-in pressure is 495 psi. Location is a mile south of New Era field.

Successful Wildcats

ALBERTA

Western 8-34 Beddington, LSD 8, 34-25-1w5. TD 9,170 ft. D1 gas well.

SASKATCHEWAN

B.A.-Calvan 10 Carduff, LSD 10, 2-3-34w1. TD 4,120 ft. Charles oil well.

LOUISIANA GULF COAST

Calcasieu Parish: General Crude Oil Co. and Harry Hurt 4 Lutcher-Moore, 15-7s-11w. IP 122.54 BOPD, ⅛-in., 44.6°, GOR 587 cu. ft. per barrel, perfs. 9,319-30 ft. TL 9,650 ft. (New pay in Cowards Gully field.)

Cameron Parish: Humble Oil & Refining Co. 1 Stine heirs, 29-15s-10w. IP 360 M.c.f. daily, ⅛-in., dry gas, perfs. 6,664-78 ft. TD 12,000 ft. (New field.)

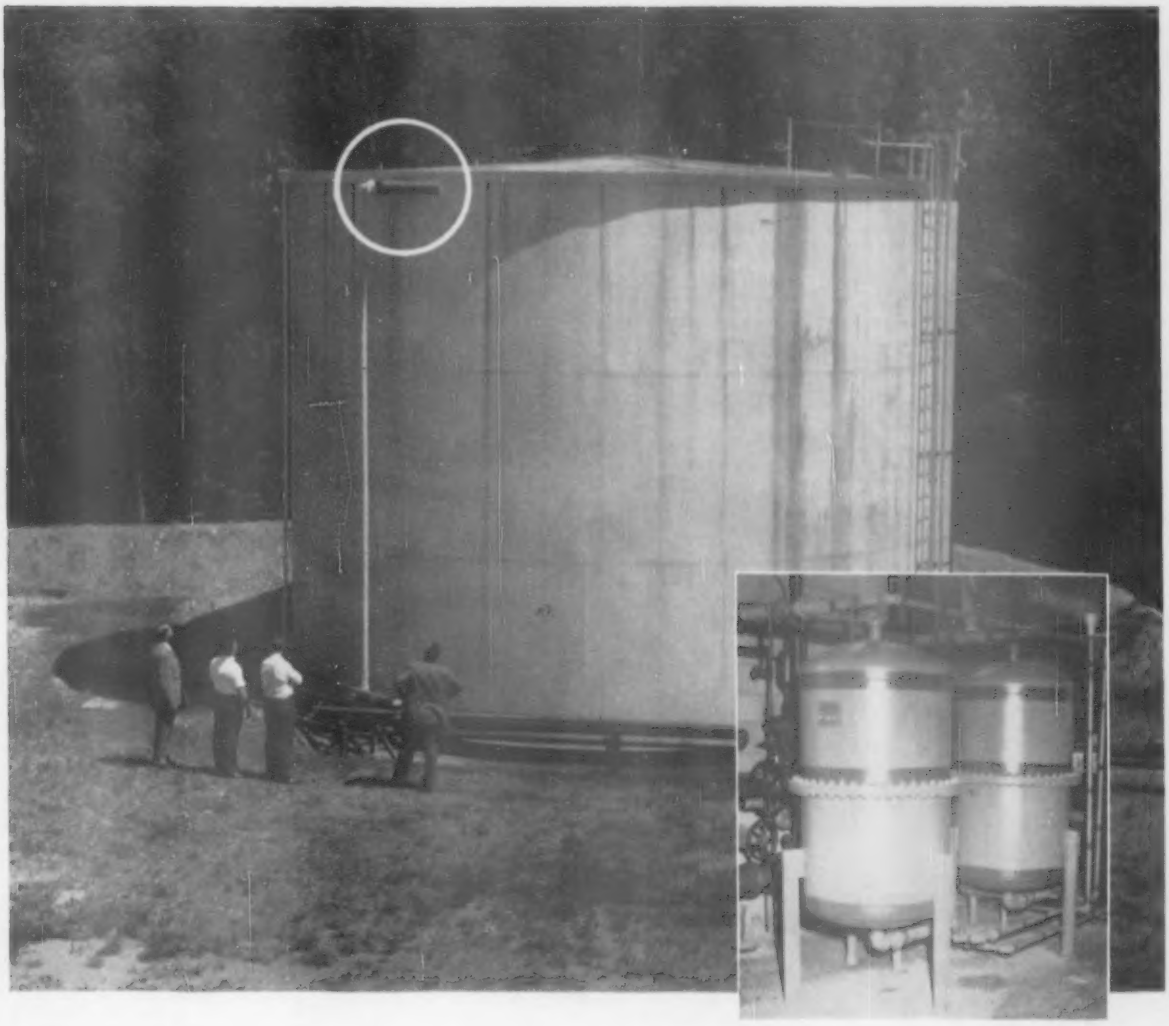
Iberia Parish: Humble Oil & Refining Co. 1 Bayou Postillion Oil Unit 3, 35-13s-11e. IP 192 BOPD, ⅛-in., 36.5°, GOR 990 cu. ft. per barrel, perfs. 11,856-62 ft. TD 12,913 ft. (New pay in Bayou Postillion field.)

Jefferson Parish: Continental Oil Co. (operator for C.A.T.C. group) 1-A OCS O175 (State Lease 1490), Blk. 43, Grand Isle area, Gulf of Mexico. IP 75 BCPD and 1,287 M.c.f. daily, ⅛-in., 52.3°, perfs. 12,731-41 ft. TD 15,523 ft. (New offshore field.)

EAST TEXAS

Panola County: Lyons & Logan 3 Burnett, TCRR Sur. 26, 7½ miles SW Blocker, new oil pay in Carthage field. Dual completion, IP from new pay, Collins sand (Travis Peak), 147 BOPD, 7/16-in., CP 100 psi., GOR 490, 42°, perfs. 6,395-6,400 ft. IP from regular pay 115 BOPD, ¼-in., TP 175 psi., GOR 650, Burnett sand 6,257-64 ft. TD 6,450 ft., elev. 223 ft.

Rusk County: Arkansas Fuel Oil Co. 1 Al-



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ford-Markey, Patrick Quatermas Sur., A-655, 5 miles SE Henderson. IP 4,280 M.c.f. gas, plus 32 bbl. 62° condensate per 1,000 M.c.f., TP 1,385 psi., Travis Peak perfs. 7,387-7,400 ft. TD 7,910 ft., elev. 468 ft.

NORTH TEXAS

Baylor County: Crown Central Petroleum Corp. 1 Seydler, Sec. 96, T&NO Sur., A-741, 4 miles SW Seymour. IP 34 BOPD, 15/64-in., 35°, TP 130 psi., GOR 1670, Tannehill sand 1,282-85 ft. TD 1,551 ft.

Grayson County: Allen Guiberson 1 M. J. Turner, J. B. McAnair Sur., new pay in Sherman field, in Sherman Townsite. IP 163 BOPD, 20/64-in., TP 1,300 psi., 40°, GOR 1830, Turner sand 8,530-40 ft. TD 9,410 ft.

Jack County: Nash Oil Co. 1 Doss, R. Tinney Sur., A-1197, 10 miles SW Jacksboro. IPP 144 BOPD, 40°, GOR 500, perfs. 2,870-76 ft. TD 2,885 ft.

Knox County: Schulz & Brannan Drilling Co. 1 Offutt, 74-2-D&W, 1 mile N Munday. IPP 28.8 BOPD, 40°, GOR 100 Tannehill sand 2,024-28 ft. TD 2,101 ft.

Wise County: Christie, Mitchell & Mitchell 3-B Kaker, W. C. Harris Sur., A-40, new pay discovery in Bridgeport field. IP 192 BOPD, 16/64-in., CP 160 psi., 41°, GOR 809, Caddo conglomerate 4,665-75 ft. TD 5,898 ft.

Young County: C & H Oil Co. 1 Goldston, Kellum Sur., A-1782, 9 miles SE Graham. IP 125 BOPD, 12/64-in., TP 200 psi., GOR 565, 42°, perfs. 4,090-4,100 ft. TD 4,517 ft. J. W. Hastings 1-A Holcomb, R.

TEXAS GULF COAST

Liberty County: Lenoir M. Josey, Inc., 1 Johnston & Campbell, Hugh B. Johnston Sur., A-55. Shut-in gas well, no gage, shut-in pressure 2,100 psi., perfs. 7,498-7,504 ft. (Yegua). TD 8,649 ft. (Discovery well of new fault block in Hardin area.)

Polk County: Robinson Oil & Gas Co. 1 Howard et al., Augustine Viesco Sur. IP 13,000 M.c.f. daily, open-flow potential, dry gas, shut-in pressure 1,154 psi., perforations 2,716-20 ft. TD 3,352 ft. (New pay in East Copeland Creek field.)

San Patrio County: Arkansas Fuel Oil Corp. 1 Brewster-Bee Unit, Burton & Danforth Sur., Tract 5, Block S (3 miles south of Aransas Pass). IP 165.60 BOPD, 9/64-in., 39.9°, perfs. 7,675-78 ft. TD 9,055 ft. (New field—South Aransas "G" Sand.)

Refugio County: Union Producing Co. 35 Fox, William Hews Sur., A-33. IP 9,600 M.c.f. daily, open-flow potential, GOR 100 M.c.f. per barrel, 55°, perfs. 7,470-76 ft. (New pay in Hynes Ranch field.)

WEST TEXAS

Ector County: U. S. Smelting, Refining & Mining Co. 1 Slater, 10-42-T4S-T&P, 13 miles SE Odessa. IPP 42 BOPD, 32°, GOR zero, Queen sand 4,490-4,525 ft. TD 14,435 ft., PB 4,740 ft. Elev. 2,904 ft., Ellenburger 14,165 ft.

Winkler County: Sunray Mid-Continent Oil Co. 6 Hill, 22-11-PSL, 9 miles SE Wink, Devonian pay opener in Halley field. IP 413 BOPD, 16/64-in., TP 2,100 psi., GOR 2404, 35°, perfs. 9,884-9,900 ft. TD 11,661 ft.

Superior Oil Co. 1-A Walton, 21-B3-PSL, 4 miles NE Kermit. IP 243 BOPD, 19/64-in., TP 900 psi., GOR 1050, 43°, Ellenburger top 10,583 ft., perfs. 10,632-36, 10,642-50 ft. TD 10,695 ft., elev. 2,922 ft.

SOUTHWEST TEXAS

Starr County: Breuer-Robison Oil Co. et al., 2 Marrs McLean estate, Porcion 80, Share 20-B. IP 9,000 M.c.f. daily, open-flow potential, perfs. 2,644-48 ft. TD 2,670 ft. (New pay in Zim-Ricaby field.)

Atascosa County: New-Tex Oil Co. 1 Toughstone, T. Thomas Sur. 513½. IPP 20.03 BOPD, 39°, open hole 1,049-1,161 ft. TD 1,161 ft. (New field.)

SOUTHEAST NEW MEXICO

Lea County: Cactus Petroleum Co. 1-A Union-State, 33-16s-33e. IPP 50 BOPD, 35°, San Andres 4,388-4,422 ft. TD 4,579 ft.

Roosevelt County: Magnolia Petroleum Co. 1 Jacobs-Federal, 18-8s-35e. IP 218 BOPD, 10/64-in., 46.7°, TP 1,200 psi., GOR 1486, Pennsylvanian 9,202-10 ft. TD 11,907 ft., PB 9,261 ft., elev. 4,246 ft.

COLORADO

Moffat County: U. S. Smelting, Mining & Refining Co. 1 Government-Winder, SW NE NE 33-8n-90w. IP 14,000 M.c.f. of gas per day, Lance discovery, new field. TD 3,075 ft. Lewis.

Weld County: Mountain Valley Oil Co. 1 Hallett, C SE SE 35-19n-59w. IP 1,250 M.c.f. of gas per day, "J" sand discovery, new field. TD 6,990 ft.

UTAH

San Juan County: The Texas Co. 4 Navajo "C," SW SE SW 26-40s-24e. IPF 642 BOPD, 1-in. choke, Hermosa discovery, new field. TD 5,993 ft. Paradox.

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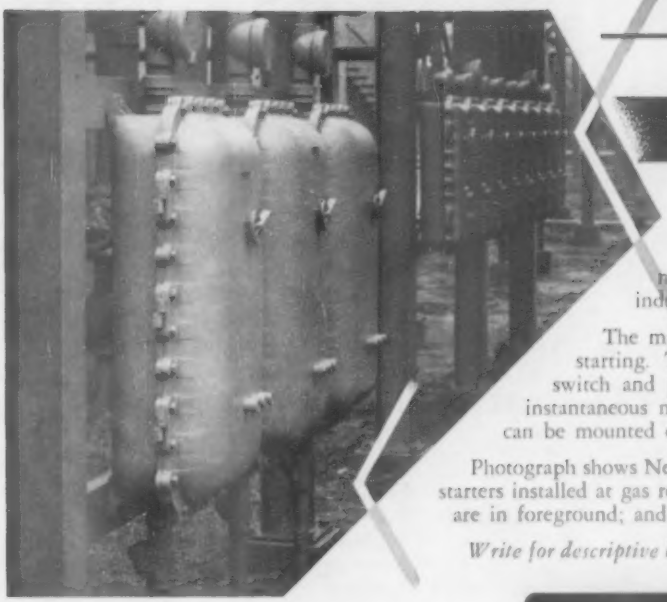

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Write for descriptive bulletin 420.

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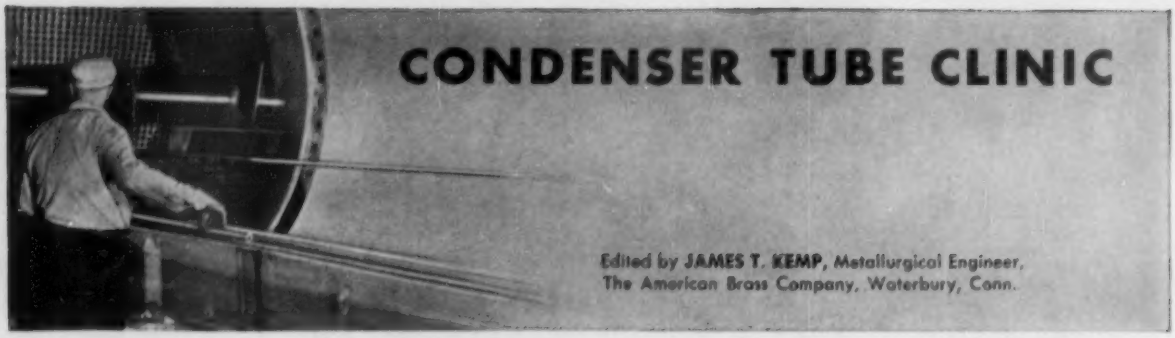
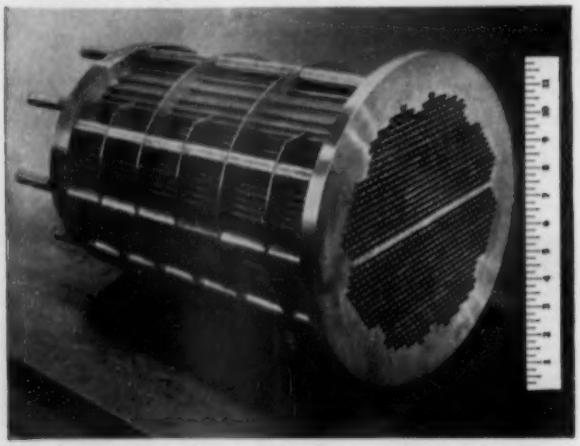


CONDENSER TUBE CLINIC

Edited by **JAMES T. KEMP**, Metallurgical Engineer, The American Brass Company, Waterbury, Conn.

20" x ¼" O.D. Tubes need Same Care and Attention as large 60-foot Condenser Tubes

The Tube Bundle shown below is only 12 inches in diameter and 20 inches long. It is the heart of the compact, efficient lubricating-oil cooler built by the Andale Company, Lansdale, Pennsylvania.



In each bundle there are 946 tubes, each 20 inches long, ¼-inch O.D. by 0.035-inch wall thickness. They are of ANACONDA Phosphorized Arsenical Copper-108 for fresh-water duty or of ANACONDA Ambraloy-927 (Aluminum Brass), ANACONDA Cupro Nickel, 10%-755, or ANACONDA Cupro Nickel, 30%-702 for salt water. They are expanded in high-strength rolled ANACONDA Ambraloy-917 (Aluminum Bronze) tube sheets.

When the tubes are brass, the complete tube bundle is stress-relieved as an assembly at a temperature of 550 F.

These small tubes—cut to short lengths, with ends burnished, highly finished surfaces inside and out, close dimensional tolerances—are typical of The American Brass Company's product, although at the lower end of the schedule of sizes.

The Same Precision in control of alloy, dimensions, anneal or temper governs the manufacture of all ANACONDA Heat Exchanger Tubes in the plants of The American Brass Company—from these little oil-cooler tubes on up to the largest sizes used in sugar evaporators, and the long lengths needed in high-pressure feed-water heaters in steam power stations.

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Technical Assistance. Our Technical Department is regularly helping manufacturers, electric companies, marine operators, petroleum and chemical companies to select the correct tube alloy for many types of condensers and heat exchangers. This service is available to you without obligation. Write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

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ALLOY	Tensile Strength, psi	Yield Strength at .5% Elongation Under Load, psi	Elongation in 2", %	Rockwell Hardness, B Scale	Density, Lb. per Cu. in.	Thermal Conductivity, B.T.U./Sq. Ft./ In./Hr./°F. at 68° F.	Average Coefficient of Linear Thermal Expansion per °F. (77-572 F.)
Arsenical Admiralty-439	52,000	22,000	60	6-45	0.308	768	.0000112
Ambraloy-927	60,000	27,000	55	35-65	0.301	696	.0000108
Ambraloy-901	60,000	30,000	60	30-60	0.295	552	.0000099
Cupro Nickel, 30%-702	55,000	22,000	50	30-60	0.323	204	.0000090
Cupro-Nickel, 10%-755							
Light Annealed	44,000	22,000	46	25	0.323	314	.0000093
Light Drawn	60,000	57,000	15	68			
Red Brass-24	42,000	13,000	50	0-30	0.316	1104	.0000104
Ambronze-421	46,000	20,000	55	0-30	0.316	830	.0000102
Phosphorized Arsenical Copper-108							
Light Drawn	40,000	35,000	20	20-50	0.323	1344	.0000098
Hard Drawn	54,000	50,000	8	50-70			
Phosphorized Copper-103							
Light Drawn	40,000	35,000	20	20-50	0.323	2364	.0000098
Hard Drawn	54,000	50,000	8	50-70			

*Note: The above values are approximate and should not be used for specification purposes. *Light annealed except as noted.*

Ideas unlimited born at Ohio . . .

. . . Yost Pioneers New Approach

JACQUE YOST is a new type of oil man. He's more at home with an electronic computer than with a drilling rig or a christmas tree. But he's the kind of expert many oil companies are discovering as one of their top assets.

Yost's new job is director of Ohio Oil Co.'s newly opened Denver research center. The way management looks at it, Yost's task is to uncover new and better ways of finding oil and ways to get more of it out of the ground.

The alchemy of oil, Yost believes, requires a blend of rockhounds, drilling engineers, gagers, and electronic computers — all liberally sprinkled with scientific know-how.

A big problem . . . Stirring up such a recipe isn't an easy job, but for Yost it's a natural.

His 15 years in the oil business have given him experience ranging from electrical prospecting to studying multiphase flow in reservoirs. He's also set up mathematical problems for electronic computers.

He heads a new staff where Ph.D.'s are as common as high-school diplomas, but oil research experience is short. Yost, a Ph.D. himself and a former college instructor, thinks that it won't take long, though, to get his scientists to solving petroleum problems.

Yost came to Ohio Oil in 1954 after 13 years with Magnolia Petroleum Co. He had been technical adviser to the director of Magnolia's research department and thus was a top prospect for Ohio when it began considering oil research.

Yost's first months with Ohio were pretty lonely. He was forced to build a research staff from scratch. His first staff members were a handful of seasoned oil researchers like himself. With this nucleus he has built Ohio's technical staff to 19—mainly young scientists new to oil research.

These "idea men," Yost feels, will be the key to finding new solutions to old research problems. Unhampered by past failures they will find ways to do things that "can't be done." He hopes to encourage these bright young men to think up ideas by having them set aside part of their time to work on personal scientific projects off the regular schedule.

The spark plug . . . Yost's mild manners belie the fact that he is the sparkplug of Ohio's research.

A 43-year-old native of West Virginia, his early adult years were spent in an academic atmosphere. He first was graduated from Furman College in Greenville, N. C., with degrees in mathematics and physics. From Furman he moved to Syracuse University to receive an M.S. in physics and then went on to Brown University, where he acquired a doctorate in physics and a wife.

The Yosts then settled down to teaching at Syracuse. Here Yost first became interested in oil, particularly in the tremendous strides made in oil finding by seismic prospecting. It wasn't long until Magnolia lured him to its field research labs in Dallas.

Yost's first 5 years with Magnolia were concerned with chemical physics, electron microscope, infrared and mass spectroscopy. Then he tried his hand at electrical prospecting, the field that attracted him to the oil business in the first place. During this time he obtained patents on low-frequency reflection prospecting, worked on continuous velocity logging, and helped set up Magnolia's digital computer. During the war he worked with the office of naval research on underwater acoustics.

A natural athlete, Yost relaxes with a fast game of tennis. He's an avid member of a tennis group in Denver. With his two sons, 10 and 12 years old, he blends right into his Rocky Mountain surroundings. All are enthusiastic mountain climbers. The boys love sailing and fishing, and Yost is right with them when duties permit.

Personals

David K. Kirk, geophysicist for Gulf Oil Corp., has been transferred to Oklahoma City from Ardmore, Okla.

Bob L. Thompson, geologist with Cities Service Oil Co., has been transferred to Oklahoma City from Bismarck, N. D.

Clyde D. Towery has been transferred by Anderson-Prichard Oil Corp. to Oklahoma City from Lyons, Kans., as petroleum engineer.

Harry Fenton has joined British-American Oil Producing Co. in Oklahoma City as geophysicist. Fenton was formerly with Advance Exploration Co. in Houston.

Harry Owens, district geologist with Humble Oil & Refining Co. in Wichita Falls, Tex., and **Bert Gorrod,** also geologist with the company in Wichita Falls, have been transferred to the company's new office in Amarillo, Tex.

I. W. Scroggin, staff engineer in the New York manufacturing department of Cities Service Petroleum, Inc., has been appointed assistant plant manager in charge of technical services at the Cities Service East Chicago, Ind., refinery. Scroggin has been with Cities Service since 1946.

Merlin A. Johnson, geologist for Gulf Refining Co. in Evansville, Ind., has been named exploration geologist for Gulf Oil Corp., Oklahoma City. **Robert Butler,** geologist for Gulf in Wichita, has been transferred to Evansville replacing Johnson.

Lyle Bertrom, area supervisor for Sohio Petroleum Co. in Centralia, Ill., has been appointed division superintendent at Grayville, Ill. **Earl Coffey,** maintenance foreman in Norris City, Ill., has been transferred to Magnolia, Ark., as area supervisor. **Howard Applegate** will replace Coffey in Norris City.

Dr. George A. Harrington has been named general manager of development for Amoco Chemicals Corp., subsidiary of Standard Oil Co. (Ind.). **Howard R. Peterson** has been appointed manager of special products in the marketing department. Harrington has been market research director of Indoil Chemical Co. since 1953. He was previously with Solvay Process Co., Magnolia Petroleum Co., and Socony Mobil Oil Co. Peterson joined Indiana Standard in 1923. He has been vice president of Indoil Chemical Co. since 1949.

Pipe Liners Hold Annual Banquet

The Pipe Liners Club took time off during the American Petroleum Institute's meeting for their annual banquet. Pipeline executives shown at the head table are, left to right, C. F. Moore, retired Ohio Oil Co. pipeline executive; J. L. Latimer, chairman, Magnolia Pipe Line Co.; Loren F. Kahle, deputy transportation coordinator, Standard Oil Co. (N. J.); J. H. Wood, Jr., vice president, Atlantic Pipe Line Co., incoming president of the group; J. L. Burke, president, Service Pipe Line Co., past club president; Ralph K. Paine, manager, pipeline department, Standard Oil Co. of California; J. M. Linehan, president, Mid-Continent Pipe Line Co.; and Harry Moreland, president, Great Lakes Pipe Line Co.

Hazen Sears, drilling contractor, has moved his offices from Nowata, Okla., and Paola, Kans., to Tulsa.

Bill Shay, geologist with Petroleum, Inc., has opened consulting offices in Denver.

Henry E. Sneed, geologist with General Petroleum Corp. in Rock Springs, Wyo., has joined the oil and gas division of Reynolds Mining in Durango, Colo.

Sun Oil Co. has made a number of appointments in its Latin American division as a result of the company's expanding foreign operations. Latin American division hedaquarters will be in Philadelphia. **Earl B. Wilson, Jr.,** has been named assistant to the division manager, **B. E. Warren. W. W. Delahoussaye,** junior petroleum engineer, has been assigned to the division, and **Ira D. Weatherford** has been appointed drilling superintendent in Maracaibo, Venezuela. **John F. Harvey,** Salt Lake City, has been transferred to Bogota, Colombia, as district geologist. **David C. Harrell** has been transferred from Jackson, Miss., to Caracas, Venezuela, as district geologist, and **D. J. Munroe** has been transferred to Guatemala City, Guatemala, from Tallahassee, Fla., in a similar capacity. **D. H. Cradwell,** Dallas, will be district geologist in Havana, Cuba. In other appointments, **John A. Waller** will move from Beaumont, Tex., to Caracas, as district geophysicist; **C. E. Lehecka,** geologist, will transfer to Lima, Peru, from San Antonio and McAllen, Tex.; and **John W. Harp,** geologist in Midland, Tex., will move to Guatemala City.

Richard W. Jones and **George E. Jones, Jr.,** have formed J & J Co., a limited partnership for exploration. Headquarters are in Los Angeles.

Thomas E. Martin, formerly with Tom Martin Drilling Co., has joined National Cooperative Refinery Association as drilling superintendent in Great Bend, Kans. He replaces **Lawrence O. Detmar,** now general production superintendent.

Lloyd E. Lundahl, assistant chief engineer for Grace Chemical Co., Memphis, has joined Great Northern Oil Co. in Pine Bend, Minn., as chief engineer and assistant maintenance superintendent. Lundahl was previously with Bechtel Corp.'s refinery engineering and construction division and with Shell Chemical Corp.

Charles Ashmun, supervisor of oil movements for Buckeye Pipe Line Co. in Lima, Ohio, has been named assistant to the president and transferred to New York. **John W. Scanlon,** assistant supervisor of oil movements, will replace Ashmun as supervisor. **Donald R. Merriman,** formerly division engineer at Macungie, Pa., has been appointed assistant to the general superintendent in Lima. **Ernest R. Shearer,** assistant superintendent of gathering lines, will be assistant superintendent, Cygnet division, Lima. **Charles R. Williamson,** foreman of gagers, gathering lines, will move up to assistant superintendent of gathering lines in Lima, replacing Shearer. **George A. Chilcote,** engineer in Lima, has been appointed division engineer and transferred to Macungie, Pa., replacing Merriman.

Walter Gasser, Pasadena, Tex., independent, has joined Bechtel Corp. in San Francisco as an engineer.

Richard J. Heider, formerly with Hancock Oil Co. in Billings, Mont., has joined Petroleum, Inc., as division manager in the Denver office. **Robert D. Cowdery** has been promoted to division geologist in the company's Denver office. Heider replaces **Woody W. Fisher,** who has resigned to become an independent operator.

C. H. Whitman, manager of Esso Standard Oil Co.'s crude oil purchasing department, Shreveport, La., will retire December 1. Whitman joined Esso Standard in 1915. He has held his present position in Shreveport since 1937. During World War II he was assistant director of the supply and transportation division of the Petroleum Administration for War and supervised the allocation of crude oil supplies on a national basis as well as management of government-owned pipelines.

P. C. Spencer, president of Sinclair Oil Corp., was elected president of the 25-Year Club of the Petroleum Industry at the group's seventeenth annual banquet in Chicago. Spencer succeeds **W. K. Warren,** chairman of Warren Petroleum Corp., Tulsa. **H. T. Ashton** of St. Louis, retired Mjddle West manager of marketing for Socony Mobil Oil Co., Inc., is executive secretary. **H. H. Hewetson,** New York City, vice president of Standard Oil Co. (N. J.), and **Harry Moreland,** president of Great Lakes Pipe Line Co., Kansas City, have been elected to the board of governors.

George W. Price, junior geologist in Sohio Petroleum Co.'s Lafayette district, has been transferred to the Gulf Coast division.

Joe B. Lewis, reservoir engineer for Shell Oil Co. in Donaldsonville, La., has been transferred to Elk City, Okla., as exploitation engineer.

Dr. Charles Van Berg has been appointed economics adviser to International Petroleum Co.'s Bogata, Colombia, representative. Van Berg was previously with Humble Oil & Refining Co.

Lee Jordan, district geologist for Bankline Oil Co. in Bakersfield, Calif., has joined Kern Oil Co., Ltd., as district geologist in the company's new Bakersfield office. **Dick Clark,** geologist with Kern, has been transferred to Bakersfield from Los Angeles.

C. B. Coker, district superintendent for Midstates Oil Corp. in Plainview, Kans., has been transferred to Odessa, Tex., in the same capacity. **W. D. Chadwick,** district superintendent in Royalty, Tex., will be assistant superintendent in Odessa. **S. G. Cohen** has also joined the company as field engineer in Odessa.

C. W. Peters, chief process engineer in Pan-Am Southern Corp.'s Destrehan, La., refinery, has been promoted to technical director. He replaces **H. A. Parker,** who has moved to the New York offices of American Oil Co. **J. H. Bryant** has been named group leader in charge of coordination and economics in the technical department of the Destrehan refinery, and **W. E. McWhirter** has been promoted to group leader in charge of technical service and process engineering.

Dr. Augustus B. Kinzel, vice president in charge of research for Union Carbide & Carbon Corp., has been elected president of the American Institute of Mining, Metallurgical, and Petroleum Engineers for 1958. **Carl E. Reistle, Jr.,** vice president of Humble Oil & Refining Co., is current president. **Grover J. Holt,** general manager of ore mining for Cleveland-Cliffs Iron Co., will replace Reistle in February. Elected vice presidents of the Institute were **Edmund C. Babson,** manager of the Canadian division of Union Oil Co., and **Roger V. Pierce,** Salt Lake City, consulting mining engineer. **Thomas C. Frick,** Dallas, manager of the production division of the domestic crude oil production department of Atlantic Refining Co., has been elected a director of A.I.M.E.

Owen Snow, district engineer with Champlin Refining Co. in Ellinwood, Kans., has joined Colorado Oil & Gas Corp. in Wichita as petroleum engineer.

Herman H. Kaveler, Tulsa petroleum engineering and management consultant, has been elected a director of Eason Oil Co., Oklahoma City. Kaveler holds B.S. and M.S. degrees from Missouri School of Mines and a Ph.D. from the University of Maryland. He was once instructor of chemistry at George Washington University and later with the U.S. Bureau of Mines in Pittsburgh. He was assistant manager of Phillips Petroleum Co.'s oil producing department in Bartlesville, Okla., when he opened consulting offices in Tulsa in 1952.

Fred T. O'Leary, senior production engineer for Continental Oil Co.'s C.A.T.C. marine region, Houston, has been promoted to superintendent of natural gasoline and gas operations for the C.A.T.C. region. O'Leary has been with Conoco since 1951.

R. M. Heskett, president of Montana-Dakota Utilities Co., Minneapolis; **N. C. McGowen,** president of United Gas Pipe Line Co. in Shreveport; and **Frank C. Smith,** president of Houston Natural Gas Corp., have been elected to the board of trustees of the Institute of Gas Technology, Chicago.

Personals

R. B. Franklin, district geologist with The Texas Co., has been transferreed to New Orleans from Shreveport, La.

R. J. Ronan has been appointed regional manager - technical services in Beacon, N. Y., for The Texas Co.

Ted Tucker has joined the geological staff of Sinclair Oil & Gas Co. in Oklahoma City. Tucker is a graduate of Oklahoma A. & M. College.

Robert W. Lane, formerly with Continental Oil Co., and **John J. McNamee,** formerly with Gulf Oil Corp., have joined the geological staff of Chicago Corp. in Casper, Wyo.

Forrest Cave and **Bill Quillen** have formed the Cave-Quillen Oil Co. in Wichita. Cave was formerly manager of the crude oil division of National Cooperative Refinery Association. Quillen was formerly manager of the Association's land department.

Stanley W. G. Lehman and **James V. Pickering** have been elected directors of Standard-Vacuum Oil Co. Lehman, Stanvac's general representative in Australia, was formerly assistant general manager of the company's marketing division in India and general manager in the Philippines. Pickering, general representative in London, was previously general manager of the company's China division and managing director of its Indonesian subsidiary.

DEATHS

Clifford Mooers, 67, retired independent oil operator of near Borger, Tex., died November 13 in New York City's LaGuardia Airport after a heart attack. Mooers was on his way to Rhode Island to see his horse, Traffic Judge, race in the Narragansett Special. Mooers, formerly of Houston, became active in the oil business near Wichita Falls, Tex., around 1918. He later operated in East Texas and in the Houston area.

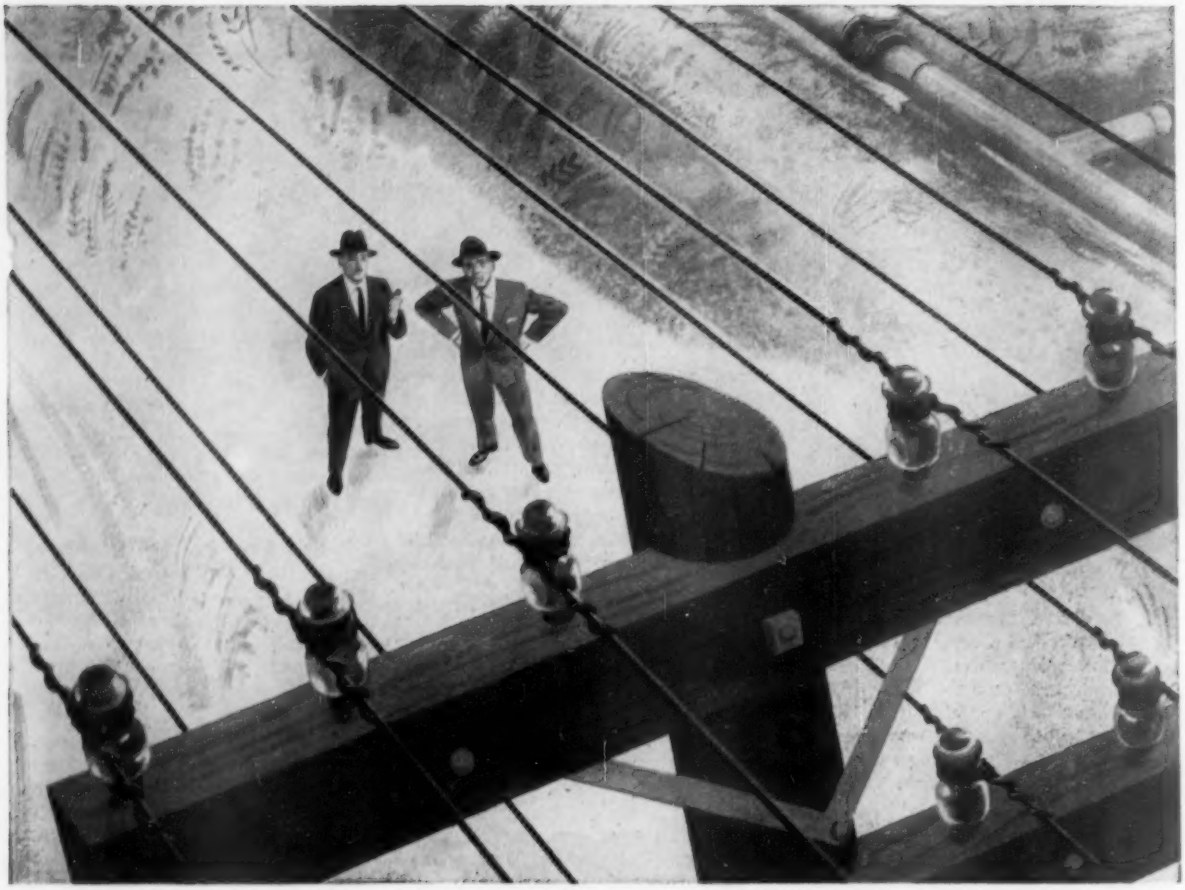
A. D. Schwander, 56, division operation manager for Humble Oil & Refining Co. in San Antonio, Tex., died there November 17.

Clyde H. Pape, 75, Tulsa independent operator, died November 18 in Tulsa. Pape was for many years connected with the old Selby Oil & Gas Co. as secretary-treasurer and head of the land department. He was a former director of the International Petroleum Exposition and of the Mid-Continent Oil and Gas Association.

Henry L. Rath, 70, retired president of Cane Creek Oil Co., died November 17 in Los Angeles. Rath was a pioneer in oil developments in the Rocky Mountain area.

Frank W. Stoddart, 54, manager of Cities Service Gas Co.'s rate and sales department and director of Cities Service Gas Producing Co., died November 15 in Oklahoma City. Stoddart has been with Cities Service since 1925 and had been department manager since 1953.

Philip Koch, 47, president of Imperial Gas Co., Los Angeles, died November 7 in Los Angeles of cancer. Koch joined Imperial in 1927 and had been president of the company since last April.



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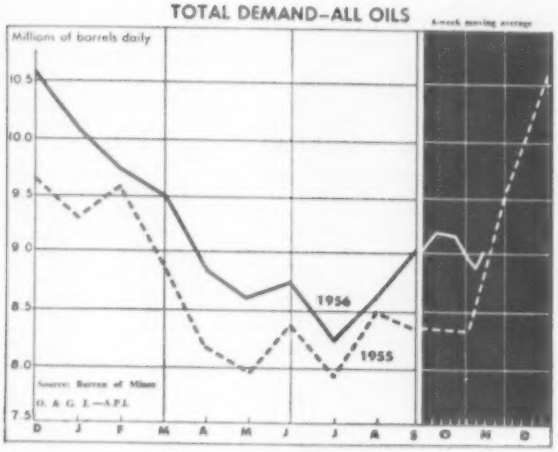
Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,159,600	UP	85,100	UP	121,433
Crude stocks	281,903,000	DOWN	928,000	UP	24,064,000
Completions	1,069	DOWN	27	DOWN	163
Refinery runs	7,965,000	UP	1,000	UP	308,000
Gasoline stocks	172,739,000	UP	896,000	UP	19,159,000
Kerosine stocks	35,978,000	DOWN	127,000	UP	834,000
Distillate stocks	160,460,000	DOWN	1,196,000	UP	11,799,000
Residual stocks	46,768,000	DOWN	657,000	UP	1,475,000
Four-product stocks	415,945,000	DOWN	1,084,000	UP	33,267,000
Total imports	1,246,900	UP	27,400	DOWN	56,100



Depending on the Product, Prices Are Under-the-Low or Over-the-High

PRODUCT prices are beginning to show the influence of the Middle East disturbance on the export demand for crude and products.

European refiners need crude from the Western Hemisphere to take the place of Middle East crude that is unavailable or has been delayed by the long haul around the Cape of Good Hope. If they can't get crude they will take light and heavy fuels. At present, there is little or no call for gasoline.

Refiners in this country, particularly on the Gulf Coast, would like to move some gasoline. Inland refiners would like to see increased movement of gasoline out of the Gulf Coast area because such movements tend to remove surplus material that will be shipped up the Mississippi River in competition with gasoline produced at refineries in the Mid-Continent and North Central areas.

Since there has been little gain in export demand for gasoline, most of the reduction in surplus over last month has been due either to good domestic demand or to the series of cuts in refinery runs.

Total gasoline stocks on September 21 were 25,139,000 bbl. more than a year earlier. By November 9, this surplus had been reduced to 19,759,000 bbl., but the excess was still enough to have a very definite influence on gasoline prices.

In the Group 3 area, regular gasoline is selling on the spot market at least as low as 11.0 cents a gallon. There have been unconfirmed reports of sales as low as 10.75 cents. These prices are for pipeline-grade material.

On the Gulf Coast, some refiners are trying to move a little gasoline along with sales of light and heavy fuels. Price wars at the retail level are indicators of the general tone of the market.

If you need some gasoline, you probably can buy it under the so-called low of the market.

On the other hand, you may offer to buy residual fuel on the Gulf Coast at a price equal to the top public quotation without finding any material available.

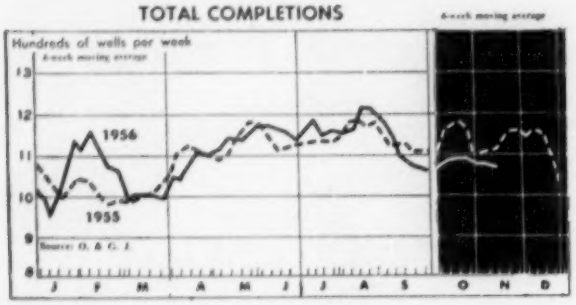
The market for residual fuel on the Gulf Coast has been firm for at least a year, but normal quotations for Bunker C ranged near $2.10 a barrel from the middle of 1955 until the second week of this month when the low of quotations moved up to $2.35 a barrel. There have been unconfirmed reports of prices as high as $2.55 a barrel, but the material moving to the Gulf Coast from the Mid-Continent will have to sell for more than this top quotation.

Residual is reported to be moving from at least two refineries in the Mid-Continent to the Gulf Coast. At least part of this fuel has been sold for $1.90 a barrel at the refinery. Transportation charges to the Gulf Coast amount to about $0.71 a barrel. If the Gulf Coast purchaser expects to make a profit above his handling and storage costs, he will have to sell the fuel for about $2.70 a barrel.

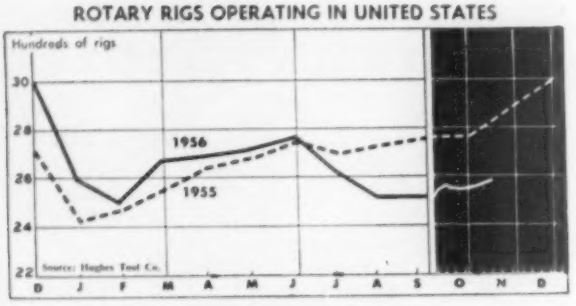
Also, this material cannot move to the East Coast and be marketed at current prices. The New York Harbor barge price moved up $0.25 a barrel on November 15 to $3.05 a barrel. The difference of $0.35 between New York Harbor barge quotations and the probable selling price on the Gulf Coast certainly won't cover transportation, storage, and a profit on the East Coast. The cost of the Gulf-East Coast tanker movement alone is more than a dollar, based on the latest spot tanker rates.

If you need residual fuel from the Gulf Coast, you probably will have to pay more than the so-called market high.

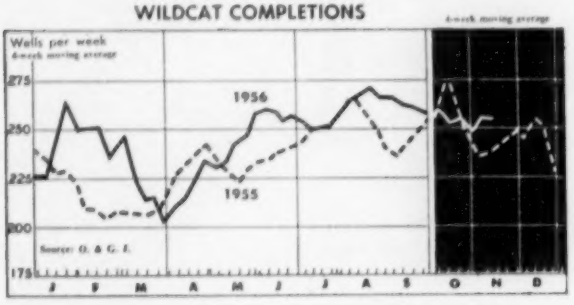
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	11-19-56	11-12-56	11-21-55
North Central and East	114	112	151
Southeast	36	38	40
Okla., Kans., Ark., Mo.	444	440	564
Louisiana	488	456	412
North and East Texas-Panhandle	398	383	416
Gulf and South Texas	249	250	262
West Texas-New Mexico	500	513	609
Rocky Mountain	236	252	299
Pacific Coast	117	114	145
Total United States	2,582	2,558	2,898
Western Canada	244	252	216

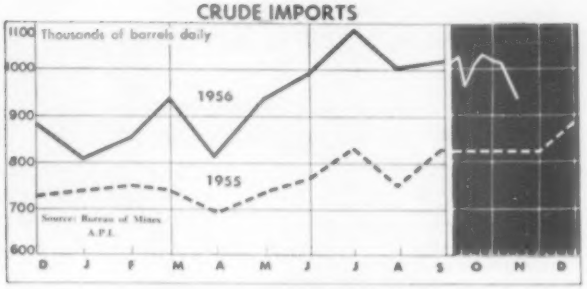
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED NOVEMBER 17, 1956

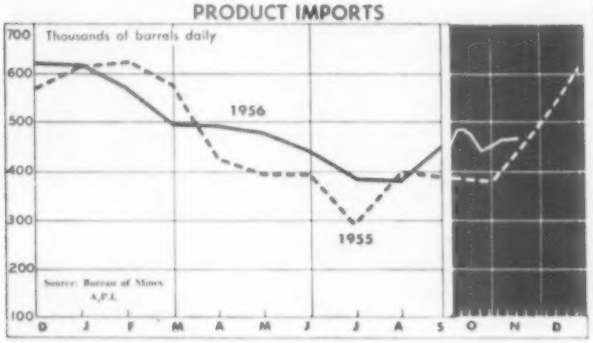
	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1956				
	Comp.	Oil	Gas	Dry	Footage	1956	1955	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	1	1	0	0	3,008	99	67	0	0	0	0	0	0	0	1	43	44
Arkansas	33	26	0	7	79,341	849	724	1	0	0	0	1	32	0	7	126	165
California	56	40	0	16	249,738	1,958	2,151	0	0	0	12	12	46	0	9	399	454
Colorado	21	2	1	18	103,175	1,068	1,324	0	0	0	15	15	24	0	15	541	580
Illinois	60	25	0	35	139,071	3,463	3,444	1	0	0	13	14	46	0	4	629	679
Indiana	22	6	0	16	37,192	627	643	0	0	0	5	5	16	0	1	110	127
Kansas	77	37	4	*36	274,885	4,374	4,442	3	0	1	14	18	113	4	39	800	956
Kentucky	49	19	3	27	77,944	1,686	1,421	2	0	0	6	8	38	0	1	345	384
Louisiana	106	54	7	45	820,385	3,371	3,581	1	0	2	21	24	104	48	54	476	682
North	42	28	1	13	145,993	1,483	1,854	0	0	0	5	5	31	2	3	197	233
South	43	18	2	23	443,033	1,520	1,727	1	0	1	15	17	59	40	37	247	383
Offshore	21	8	4	9	231,359	368		0	0	1	1	2	14	6	14	32	66
Michigan	7	2	0	5	20,433	387	469	0	0	0	3	3	9	0	2	137	148
Mississippi	8	2	0	6	52,648	389	403	0	0	0	4	4	15	1	1	174	191
Montana	14	2	0	12	65,245	415	361	0	0	0	10	10	11	0	1	149	161
Nebraska	14	4	0	10	77,831	836	784	0	0	0	6	6	35	0	1	379	415
New Mexico	32	16	10	6	164,606	1,692	1,509	1	0	0	5	6	47	1	9	186	243
Northwest	11	0	9	2	32,081	754	519	0	0	0	2	2	12	0	7	68	87
Southeast	21	16	1	4	132,525	938	990	1	0	0	3	4	35	1	2	118	156
North Dakota	3	2	0	1	20,724	235	232	0	0	0	1	1	8	0	0	61	69
Ohio	18	4	5	‡9	39,159	952	1,085	0	0	0	0	0	2	0	4	6	12
Oklahoma	157	94	4	‡59	492,428	7,299	7,568	3	0	0	14	17	114	18	34	606	772
Pennsylvania-New York	1	0	1	0	7,585	960	1,333	0	0	1	0	1	0	0	14	17	31
Texas	347	203	18	126	1,622,373	19,343	17,866	11	0	5	79	95	666	31	175	4,075	4,947
Southwest (1 & 4)	34	16	4	14	166,979	2,749	2,755	2	0	1	10	13	120	6	61	775	962
Gulf Coast (2 & 3)	55	30	7	18	382,164	2,322	2,247	0	0	3	9	12	60	16	64	619	759
East (5 & 6)	32	16	2	14	180,400	1,033	868	0	0	0	13	13	14	2	6	353	375
N. Central (7-B & 9)	111	54	0	57	336,211	6,885	6,652	3	0	0	32	35	290	0	11	1,614	1,915
West (7-C & 8)	92	72	2	18	474,793	5,187	4,401	6	0	0	14	20	164	0	11	648	823
Panhandle (10)	23	15	3	5	81,826	1,167	943	0	0	1	1	2	18	7	22	66	113
Utah	4	2	0	2	25,584	124	80	1	0	0	2	3	10	0	5	63	78
West Virginia	10	2	8	0	28,443	606	580	0	0	0	0	0	0	0	11	9	20
Wyoming	29	13	4	12	109,698	796	808	0	0	0	7	8	17	0	10	218	245
Miscellaneous	0	0	0	0	0	71	58	0	0	0	0	0	4	0	0	60	64
Total U. S.	**1,069**	556	65	448	4,511,496	51,600	50,933	25	0	9	217	**251**	1,357	103	398	9,609	11,467
Total previous week	1,096	550	87	459	4,343,540			30	0	11	221	262	1,332	103	389	9,392	11,216
Total Nov. 19, 1955	1,232	697	75	460	4,762,622			26	4	6	214	250	1,442	192	307	8,972	10,913
Cumulative 1956	51,600	27,660	3,611	20,329	207,178,683												
Western Canada	97	67	5	25	424,861	2,869											

Service wells included: *3, †5, ‡19.

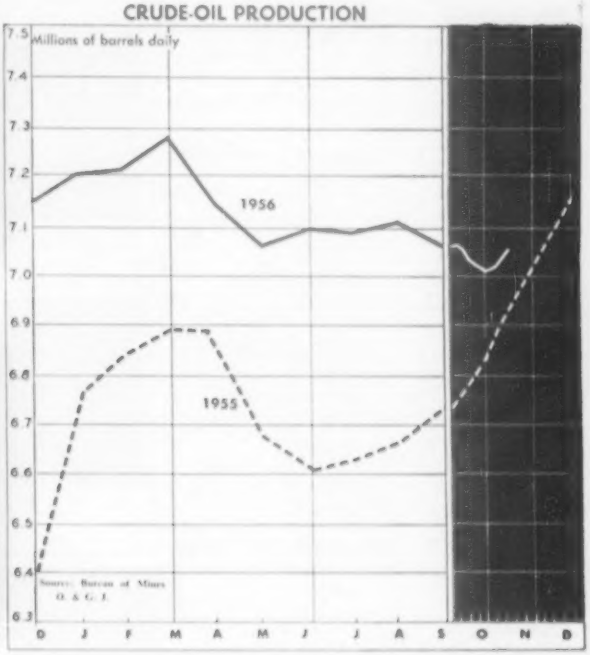
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION



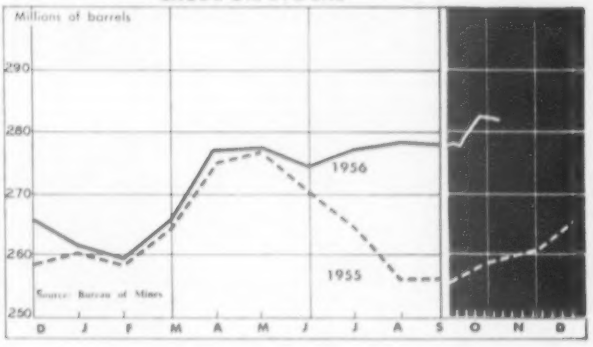
DAILY AVERAGE PRODUCTION FOR WEEK

	November 17, 1956			Nov. 10
	Crude oil	Lease condensate	Total	total
Alabama	11,200		11,200	11,300
Arkansas	77,800	300	78,100	78,200
California	952,200		952,000	953,400
Colorado	150,700		150,700	155,300
Eastern	50,500		50,500	50,100
Florida	1,275		1,275	1,275
Illinois	240,800		240,800	237,800
Indiana	32,000		32,000	32,000
Kansas	341,300		341,300	320,900
Kentucky	46,800		46,800	48,900
Louisiana	765,650	66,300	831,950	796,650
North	117,000	2,300	119,300	119,300
South	648,650	64,000	712,650	677,350
Michigan	29,700		29,700	26,600
Mississippi	108,950	5,000	113,950	113,950
Montana	58,800		58,800	59,000
Nebraska	38,700		38,700	39,000
Nevada	200		200	200
New Mexico	246,225	4,200	250,425	250,225
North Dakota	36,200		36,200	36,100
Oklahoma	†586,300		†586,300	†555,100
Texas	2,951,600	54,500	3,006,100	3,006,100
Dist. 1	57,000	550	57,550	57,550
Dist. 2	145,000	8,600	153,600	153,600
Dist. 3	417,000	26,000	443,000	443,000
Dist. 4	226,000	6,500	232,500	232,500
Dist. 5	39,000	450	39,450	39,450
Dist. 6	124,000	6,000	130,000	130,000
East Texas field	202,600		202,600	202,600
Dist. 7-B	155,000	45	155,045	155,045
Dist. 7-C	172,000	3,905	175,905	175,905
Dist. 8	1,099,000	1,600	1,100,600	1,100,600
Dist. 9	210,000	650	210,650	210,650
Dist. 10	105,000	200	105,200	105,200
Utah	7,700		7,700	7,600
Wyoming	294,600		294,600	294,700
Others	‡100		‡100	‡100
Total U. S.	7,029,300	130,300	**7,159,600**	7,074,500
Change from prev. week, up			**85,100**	
Canada	†492,700		†492,700	†451,300

Total U. S. production, January 1-November 17 . . . 2,294,719,650 bbl.
Same period last year (crude plus cond.) . . . *2,171,725,919 bbl.

*Includes 36,199,475 bbl. condensate. †Week ended previous Monday. ‡South Dakota.

CRUDE-OIL STOCKS



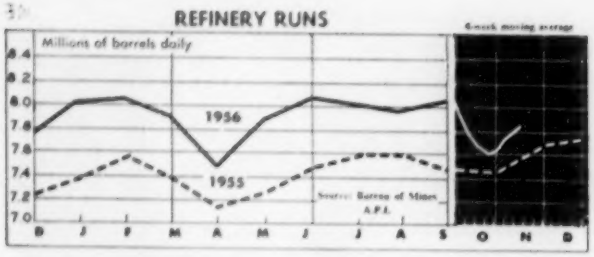
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

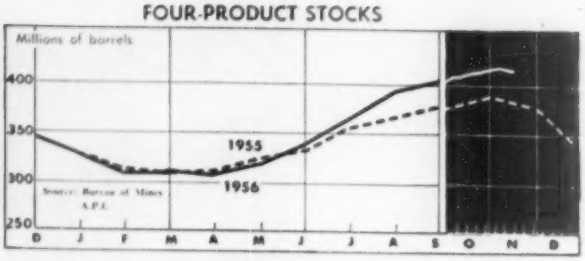
	11-10-56	11-3-56	11-12-55
Pennsylvania Grade	2,430	2,451	3,058
Other Appalachian	2,315	2,426	1,863
Illinois, Indiana, Michigan	11,858	11,786	9,538
Nebraska, North Dakota	2,389	2,157	2,380
Kansas	10,283	10,491	8,032
Oklahoma	23,916	24,594	21,402
Arkansas	2,894	3,092	2,424
Louisiana	18,366	18,300	15,947
North	2,614	2,758	2,524
South	15,752	15,542	13,423
Mississippi	3,114	3,127	3,099
New Mexico	9,433	9,218	7,179
Texas	128,227	126,522	123,035
East Texas proper	8,912	8,698	8,997
West Texas	61,742	61,161	57,721
Texas Gulf	25,045	24,413	25,464
Other Texas	32,528	32,250	30,853
Wyoming	16,515	17,468	14,619
Other Rocky Mountain	6,507	6,235	5,733
California	29,332	29,413	26,981
Foreign	†14,324	15,551	12,549
Total	281,903	282,831	257,839

*Bureau of Mines. †Includes 3,641,000 bbl. in California.

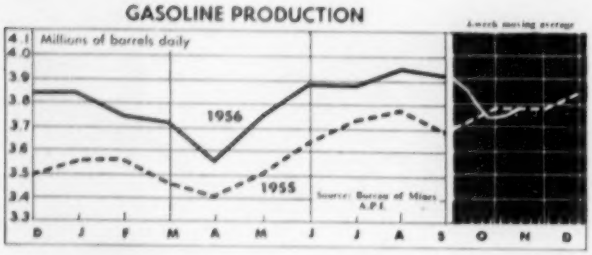
REFINERY RUNS



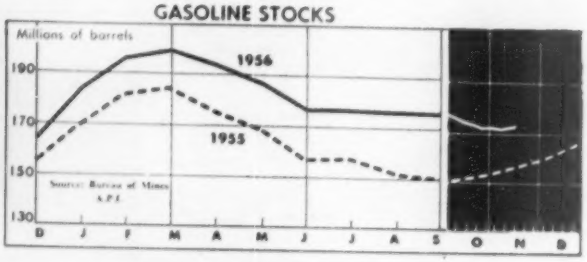
FOUR-PRODUCT STOCKS



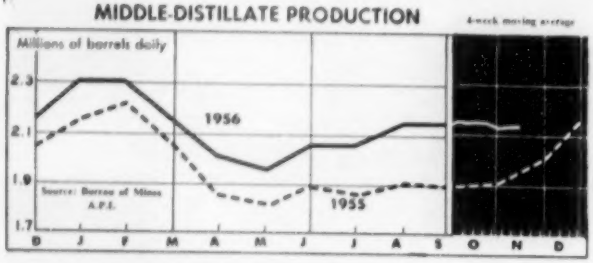
GASOLINE PRODUCTION



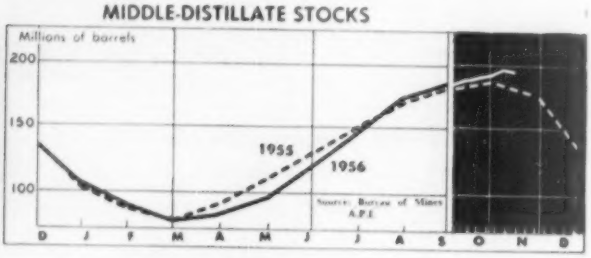
GASOLINE STOCKS



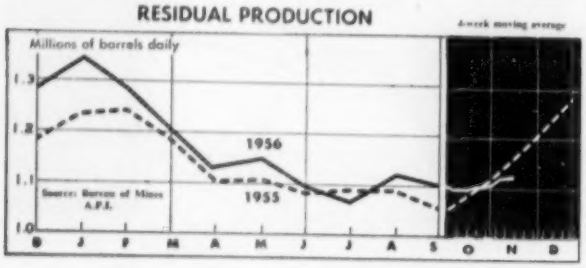
MIDDLE-DISTILLATE PRODUCTION



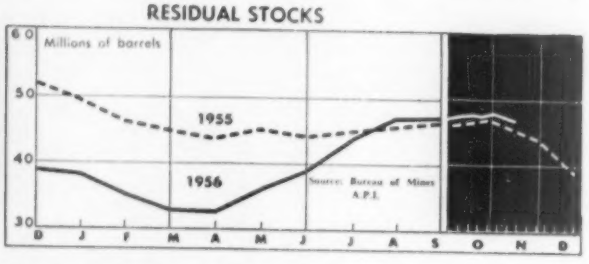
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, NOVEMBER 16, 1956

(Thousands of barrels)

District—	Daily avg. runs	Daily average production — Gaso.*	Kero.	Dist.	Resid.	Stocks‡ — Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, November 1955 — Daily avg. runs	Daily average production — Gaso.*	Kero.	Dist.	Resid.
East Coast	1,142	447.9	47.0	277.0	197.7	41,956	14,604	62,271	12,130	1,102	428.0	27.6	267.4	222.9
Appalachian:														
District 1	106	42.1	5.8	28.9	10.9	4,385	677	3,698	506	112	46.1	5.5	21.1	8.2
District 2	106	54.0	6.7	21.1	11.4	2,766	772	1,118	208	91	50.7	3.8	18.1	12.5
Ind., Ill., Ky.	1,436	735.4	76.6	300.4	182.7	28,976	7,766	25,392	5,983	1,375	751.2	73.3	272.1	192.8
Minn., Wis., Dak.	101	52.0	9.4	25.3	7.3	7,147	1,813	8,758	124	(§)	(§)	(§)	(§)	(§)
Okla., Kans., Mo.	656	357.9	10.3	160.4	31.4	13,852	1,824	13,886	1,522	693	406.2	17.8	162.9	34.9
Inland Texas	254	200.6	10.0	45.0	14.7	7,284	574	1,997	1,829	251	186.8	9.8	47.2	19.0
Texas Gulf Coast	1,947	865.9	136.8	450.0	241.7	25,195	3,696	15,980	6,932	1,940	907.8	137.3	481.2	255.1
La. Gulf Coast	667	363.4	51.3	162.4	54.9	9,932	2,620	8,016	1,619	688	357.8	54.8	165.3	48.1
N. La. and Ark.	105	40.1	9.0	22.2	5.9	4,262	864	2,291	285	97	36.7	6.4	24.9	6.7
Rocky Mountain:														
New Mexico	25	13.7	0.6	4.6	3.7	524	9	145	67	22	11.0	0.4	3.9	2.6
Other Rocky Mtn.	260	127.4	4.7	61.0	30.9	4,804	411	3,082	969	256	122.8	4.3	62.0	42.3
West Coast	1,160	482.9	5.9	179.3	334.1	21,656	348	13,826	14,594	1,065	482.7	.....	153.7	368.6
Nov. 16, 1956	7,965	3,783.3	374.1	1,737.6	1,127.3	172,739	35,978	160,460	46,768	7,692	3,787.8	341.0	1,679.8	1,213.7
Nov. 9, 1956	7,964	3,816.3	386.3	1,755.6	1,182.1	171,843	36,105	161,656	47,425	.....	.....	.....	.....	.....
Nov. 18, 1955	7,657	3,758.6	335.9	1,796.9	1,177.4	153,580	35,144	148,661	45,293	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines. §Included in Indiana, Illinois, Kentucky district.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (88 octane)	11.00-11.50
Premium (96 octane)	12.75-13.25
Gulf Coast (cargoes for coastwise or export movement):	
Regular (90 octane)	11.00-11.50
Regular (92 octane)	11.25-11.75
Premium (97 octane)	12.75-13.25
Premium (98 octane)	13.00-13.50
California—Los Angeles (rack):	
★ Regular (84 octane)	12.6
★ Premium (93 octane)	13.4-13.6
★ Premium (96 octane)	14.6
Caribbean area (cargoes):	
Regular (87 octane)	10.00
Premium (93 octane)	11.50

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for grades below 16-lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
★ Kerosine 42-44	9.875-10.00
Diesel oil (58 d.i. and above)	9.50-9.75
★ Distillate No. 1	9.50-9.75
★ Distillate No. 2	8.875-9.00
Gulf Coast (cargoes):	
★ Kerosine 41-43	9.5-10.0
Distillate No. 2	9.0
New York Harbor (barges):	
Kerosine 41-43	11.25
Distillate No. 2	10.65
Diesel fuel, 48-52 d.i.	10.95
Caribbean area (cargoes):	
Distillate No. 2	9.0

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$2.05-2.10
Gulf Coast (cargoes):	
★ Bunker C fuel	$2.35-2.50
New York Harbor (barges):	
Bunker C fuel	$3.05
Caribbean (cargoes):	
Bunker C at Aruba, N.W.I.	$2.25
California (rack):	
★ Bunker C fuel, Los Angeles	$2.25-2.50

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	24
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.75
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	27
200 vis. neutral (180 at 100°), 25 p.t.	25

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.02				
15-15.9	2.08				
16-16.9	2.13				
17-17.9	2.19				
18-18.9	2.24				
19-19.9	2.30				
20-20.9	2.35	$2.50		$2.37	
21-21.9	2.41	2.52		2.39	
22-22.9	2.47	2.54		2.41	
23-23.9	2.52	2.56		2.43	
24-24.9	2.58	2.58	$3.01	2.45	
25-25.9	2.64	2.60	3.03	2.47	$2.13
26-26.9	2.69	2.62	3.05	2.49	2.19
27-27.9	2.76	2.64	3.07	2.51	2.24
28-28.9	2.83	2.66	3.09	2.53	2.29
29-29.9	2.91	2.68	3.11	2.55	2.34
30-30.9	2.97	2.70	3.13	2.57	2.39
31-31.9	3.04	2.72		2.59	2.44
32-32.9	3.12	2.74		2.61	2.48
33-33.9	3.20	2.76		2.63	2.52
34-34.9	3.27	2.78		2.65	2.56
35-35.9	3.34	2.80		2.67	2.60
36-36.9	3.39	2.82		2.69	2.64
37-37.9		2.84		2.71	2.66
38-38.9		2.86		2.73	2.68
39-39.9		2.88		2.75	2.70
40 and up		2.90		2.77	2.72

*Includes Oklahoma, Kansas, North Dakota, West Texas (sweet), North Central Texas, North Louisiana, Arkansas. †Low-cold-test Gulf Coast. ‡Sour.

Effective dates: California, February 7, 1956; east of California, June 15, 1953; Pennsylvania Grade, August 16, 1956.

Some crudes in North Central Texas, West Central Texas, and Texas Panhandle have been shifted to the intermediate schedule with $2.83 for 40° and 2 cents per degree drop. Effective dates range from July 15, 1956, to August 10, 1956.

FLAT PRICES

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	4.68
Middle District	4.50
Southwest Pennsylvania	4.21
West Virginia	4.03
Buckeye Grade	4.07
Zanesville Grade	3.15
Illinois Basin	2.90
Canada:	
Leduc-Woodbend (flat prices D-2, D-3)	2.60
Redwater (Alta.) D-3	2.49
Smiley-Viking (Sask.)	2.26
Fosterton (Sask.)	1.29
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-49.8°, Tucupido	*$3.40
San Joaquin, 41°-41.9°, Puerto La Cruz	*$3.04
Oficina, 35°-35.9°, Puerto La Cruz	*$2.80
Tia Juana medium, 26.5°-26.9°, Amuay§	†$2.30
★ Quiriquire, 16.5°-16.9°, Caripito	‡$2.35
★ Lagunillas heavy, flat, Amuay or Las Piedras§	2.20
★ Bachaquero, 16.5°-16.9°, Amuay or Las Piedras§	‡2.05

*Plus or minus 2 cents per barrel for each degree gravity change. †Plus or minus 2.5 cents per barrel for each half-degree gravity change. ‡Plus or minus 3.5 cents per barrel for each half-degree gravity change. §Also available at La Salina at 3.0 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$1.97
Iranian, 34.0°-34.9°, Bandar Mashur	1.91
Iranian, 34.0°-34.9°, Abadan	1.86
Iraq, 36.0°-36.9°, Fao	1.87
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.72
Qatar, 39.0°-39.9°, Umm Said	2.06
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.46
Iraq, 36.0°-36.9°, Tripoli, Banias	2.46
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°-38°	2.60

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

★ Gulf-U.S.N.H., clean (USMC+205%)	$8.69
★ Gulf-U.S.N.H., dirty (USMC+200%)	8.55
★ NWI-U.S.N.H., dirty (USMC+200%)	8.10
★ Gulf-U.K., clean (USMC+225%)	17.21
★ N.W.I.-U.K., dirty (Scale+325%) (138s. 2d.)	19.22
★ P.G.-U.K., dirty (Scale+325%) (338s. 3d.) (New scale rates)	47.06

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GAS METERS FOR SALE: Foxboro and Westcott Orifice Meters, Late Type. Good Condition. George Milner, Box 124, Okmulgee, Okla.

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10—Kellogg Adm. Fltg. Hd. 2700, 2200, 1800 Sq. Ft.
6—Kellogg Steel Fltg. Hd. 1500, 800, 500 Sq. Ft.

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2 Clark RA-5 500 hp.
1 Worth LTC-3 400 hp.
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C-34 WALKER-NEER Spudder, A-1 condition. Complete with 5 and 7-in. tools. Priced to sell. Located at Drumright, Oklahoma. Contact Box 788, or Phone 20, Drumright.

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INVESTORS—East Texas acreage, active. Priced right and showing profits. Write what you want. References. Stuart Softshell Pecans, 35c Lb. 5 Lbs. up. E. M. ADAMS, Marshall, Texas.

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LEGAL

SEALED BIDS will be received until 2:00 P.M., Central Standard Time, December 11, 1956, and opened at that time in the Office of the Superintendent, Cheyenne River Indian Agency, Cheyenne Agency, South Dakota, for the leasing of 23 units comprising 8,270.80 acres of Tribal land and 1,039.70 acres of allotted Indian land, located in Township 11 North, Ranges 22 and 23 East, Black Hills Meridian, Ziebach County, South Dakota, for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent of the Cheyenne River Indian Agency at Cheyenne Agency, South Dakota, or the United States Geological Survey, Federal Building, Casper, Wyoming.

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Oil Rights Tested

Suits challenge railroads on ownership of minerals

SAN FRANCISCO. — Authority of Northern Pacific Railway Co. to reserve oil and gas rights on original land-grant properties is being challenged in the U. S. Court of Appeals here. The 3-member court has the suit under consideration.

A similar case against Union Pacific Railroad is pending in the Colorado District Court at Sterling.

Although the Northern Pacific case involves only a tract of land in Dawson County, Montana, the outcome will affect all lands granted to the railroad by the U.S. Government in 1864.

The appeal was filed by Theodore B. Russell of Des Moines, Iowa, from a decision by U. S. District Judge W. D. Murray at Helena, Mont., October 12, 1955.

Previous decision . . . Judge Murray upheld Northern Pacific's contention that it could lawfully reserve oil and gas rights on land which Russell inherited from a decedent who received it from the railroad.

Russell claims that the land-grant acts of 1864 and 1870 did not give Northern Pacific authority to reserve oil and gas rights because the railroad was bound by the acts to open the lands to pre-emption and settlement.

The act of 1870, according to Russell's arguments, erased mortgage and lien restrictions contained in the 1864 act and provided that lands granted to Northern Pacific were to be opened to pre-emptive settlement, 5 years after completion of the road, at the $2.50 per-acre price affecting other lands.

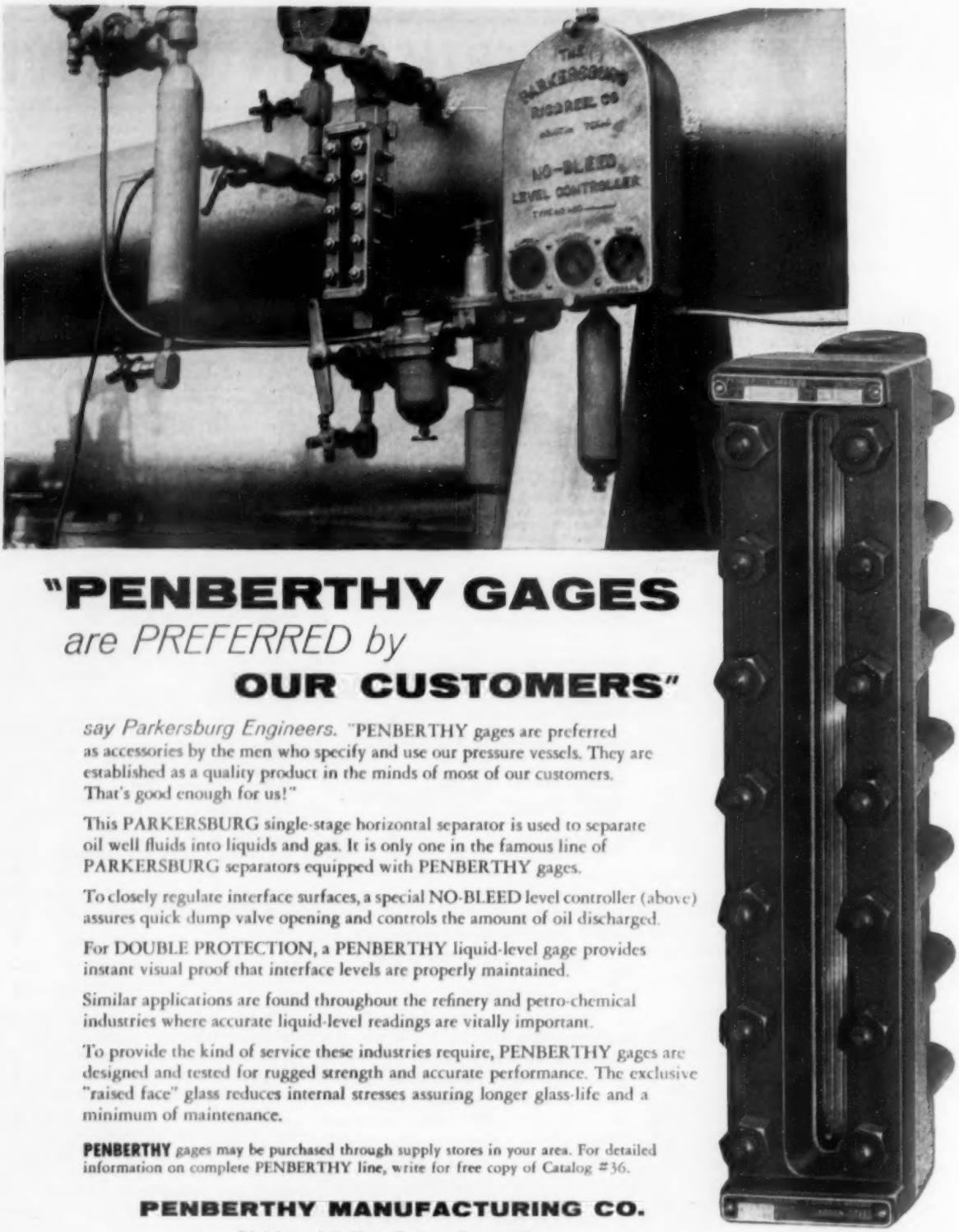
In the Union Pacific case, two Logan County, Colorado, landowners, Sara M. Radke and Edward F. Karr, are contesting the railroad's claim to oil rights on 160 acres of farmland northeast of Crook, Colo. A decision is expected soon.

Steel Outlook Is Improving

WASHINGTON.—The Business and Defense Services Administration reports an improved outlook for nickel-bearing and carbon steels in the production of oil-country tubular goods.

This is backed by a statement from the Commerce Department, that the supply of nickel is expected to improve somewhat next year, provided the status quo is maintained between military and civilian requirements and diversions from stockpile accounts continue.

The BDSA is working up a plan to obtain current information from the oil-field machinery and equipment industry regarding shipments, industry capacity, and metal consumption. This would help determine emergency allocations of materials.



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This PARKERSBURG single-stage horizontal separator is used to separate oil well fluids into liquids and gas. It is only one in the famous line of PARKERSBURG separators equipped with PENBERTHY gages.

To closely regulate interface surfaces, a special NO-BLEED level controller (above) assures quick dump valve opening and controls the amount of oil discharged.

For DOUBLE PROTECTION, a PENBERTHY liquid-level gage provides instant visual proof that interface levels are properly maintained.

Similar applications are found throughout the refinery and petro-chemical industries where accurate liquid-level readings are vitally important.

To provide the kind of service these industries require, PENBERTHY gages are designed and tested for rugged strength and accurate performance. The exclusive "raised face" glass reduces internal stresses assuring longer glass-life and a minimum of maintenance.

PENBERTHY gages may be purchased through supply stores in your area. For detailed information on complete PENBERTHY line, write for free copy of Catalog #36.

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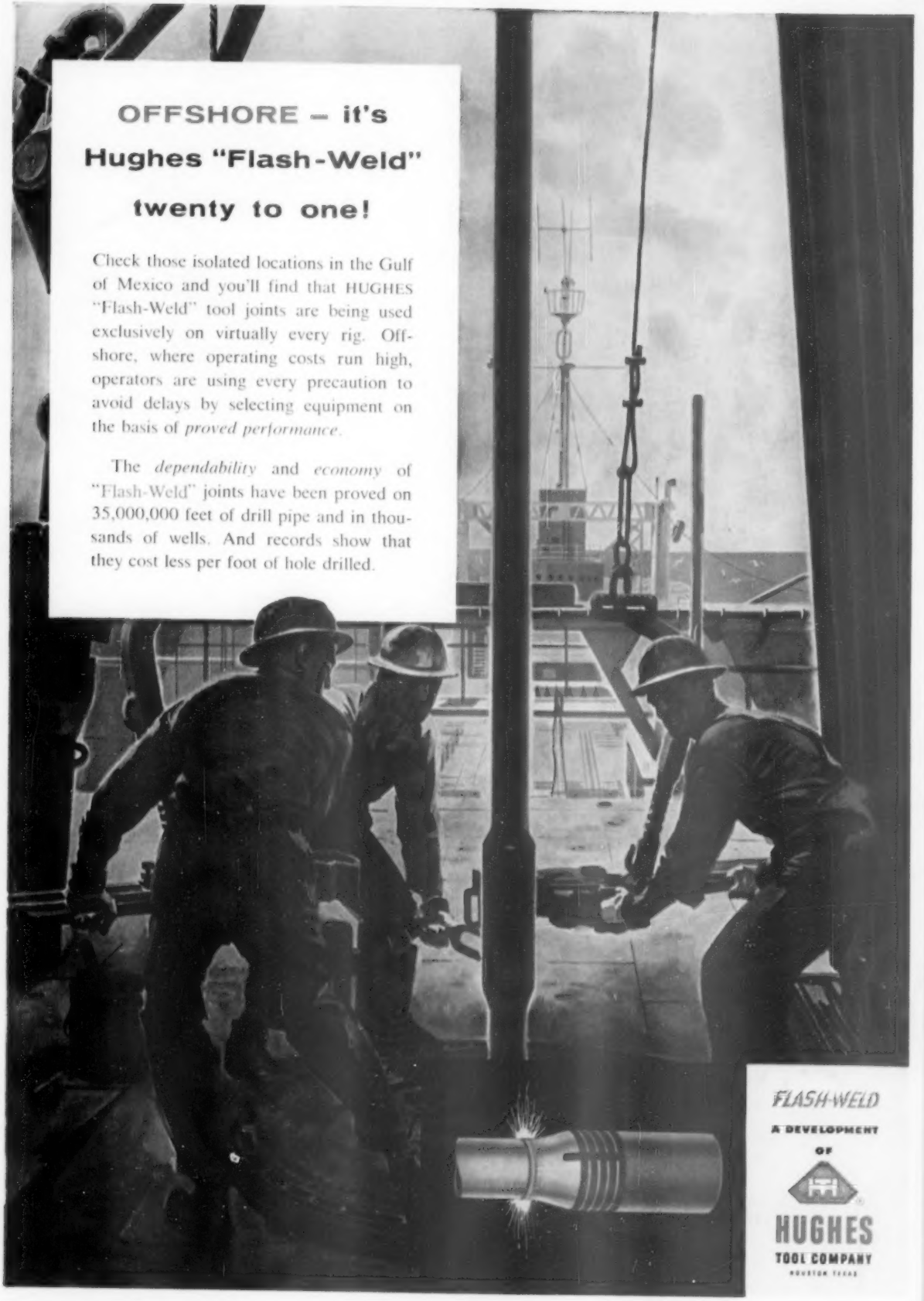

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